

THE BIOLOGIST

A Quarterly Journal Promoting Research
Interest in the Biological Sciences

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Twenty-five
Cents



September
1952

THE BIOLOGIST

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Printed by The W. H. Kistler Stat'y Co., in Denver, Colorado, for the Phi Sigma Society, a nonprofit educational organization devoted to the promotion of research interest in the biological sciences. Founded at Ohio State University 17 March 1915, the Phi Sigma Society is a member of the Association of College Honor Societies. THE BIOLOGIST is the official quarterly publication, issued ordinarily on the 15th of September, December, February, and May, as a stimulus to the fellowship in science for which Phi Sigma stands and as a medium of exchange between Chapters.

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THE BIOLOGIST

VOL. XXXV

SEPTEMBER 1952

No. 1

PHILIP HENRY GOSSE

By DAVID CAUSEY

University of Arkansas

PART I. HIS LIFE

"Gosse? Let's see . . . or, yes, wasn't he the junior author of the rotifer book?"

That was my knowledge of one of the outstanding biologists of the past century until a couple of years ago. Then, while bored as a teacher always is when an examination is going on and there is nothing to do except to study an occasional patella or to glare at an athlete trying to make a D by television, I picked up one of those five pound condensations of English Literature and ran through it. I found a delightful episode from *Father and Son*, by Edmund Gosse, in which little Edmund had been invited to a party and wanted to go. His straightlaced father objected, fearing worldly influences, and the impasse was solved in the customary manner by putting it up to God. Both knelt and prayed. Upon arising, the father, confident in his God, asked Edmund what God had told him. And little Edmund, destined from birth for the ministry, gravely replied that God had said he was to go to the party! He adds that his father jumped as though stung by a serpent. That took me to *Father and Son*, and I have been hunting Gosse books ever since. Practically all the data for this paper's biographical portion is based upon Edmund Gosse's *Life of Philip*

Henry Gosse.¹ Some data are to be found in Gosse's own books, and of course there are obituary notes. Edmund's account is, in my opinion, careless and confusing, especially about the titles and dates of his father's books. He was very proud of being "the little naturalist," which seems to mean little more than that he was an only child and motherless quite early, and his poor father had to wag the petticoated little brat along due to the lack of a baby sitter. Philip Henry must have been a difficult man to love, and it doesn't seem that Edmund cared unduly for him. The *Life* impresses me as written upon the assumption that people ought to be interested in anything about Edmund, including his father!

Philip Henry Gosse was born on April 6, 1810 at Wordhester. He was the second child of a n'er-do-well and more or less itinerate miniature painter with a secret passion for wigs, and of a long-suffering, making-ends-meet mother—a situation from which the

¹ The NEW YORKER says there are forty-six Gutenberg Bibles, and that thirteen of them are in this country. So far as I can discover, only the University of California Library has the *Life* of Gosse. I want to buy a copy! (adv.).

Micawber family might have been drawn. Philip Henry's education was meager, aside from rather random day schools and home teaching at first, he seems to have had only one full year at Blanford where he got a good fundamental knowledge of Latin and enough Greek to slip an occasional Greek word into his writings the rest of his life.

At seventeen years of age he was apprenticed to a mercantile company and left England for Labrador (1827). He found life in Labrador dull and monotonous, broken only by extensive reading, during which his passion for poetry was discovered (his writings are cluttered up with it), the making of a few friends and the beginnings of his religious interests, and a developing interest in insects which ultimately made a naturalist of him. This was done the hard way, with a few books and no guidance,¹ and curiously enough, in an area not too well supplied with species for study. He served out his indenture with the mercantile company and stayed on an extra year. Then, influenced by his friends, the Jacques, he resigned to go with them to Canada.

He left Carbonear on Midsummer Day, 1835, walking to Harbor Grace, where he was joined by the Jacques. On the walk he found and captured a long sought yellow swallow-tail butterfly, and that evening, after he had gone on shipboard, a boy brought him a big cockroach as a parting gift. His only note about Quebec seems to be that there he got lettuce for his hungry caterpillars. Being advised not to go to Upper Canada as planned, he visited and then bought a farm jointly with the Jacques in the township of Compton in Lower Canada, near the Vermont line. The 110 acre farm was soon divided between them after an initial effort to work it together had failed. He boarded with the Jacques. For some 18 months he was quite hopeful, trying to make a living farming, supplementing it with winter school teaching, and collecting insects after the day's work was done. The Canadian glamor faded rapidly, the work was hard and he had no experience with

farming, the winters were severe, and no doubt he neglected his farm work for the more alluring pursuit of insects. During this period he completed his *Entomology of Newfoundland*, an unpublished work which represented the training he had given himself in that field. That he was somewhat frustrated by his situation is indicated by his having advertised his farm for sale in July, 1837, and by September was planning to build a house, but in November was writing his sister Elizabeth about the possibility of getting some sort of teaching position in England—he was tired of living on "buckwheat and pigmeat!" The farm was sold in 1838 and his friend Jacques took him in a wagon as far as Burlingham, on Lake Champlain.

"This is the moment, perhaps, briefly to recapitulate the results of the three years which had elapsed since he left Newfoundland. As a monetary speculation, he had done deplorably. He was twenty-eight years of age, and he was not possessed, when all his property was sold, of so many pounds. By his change from Carbonear he had greatly increased his toil; he had lived much more meanly and on a coarser fare, had been more poorly clad, and had suffered in general health . . . But the great, the only counterbalance to the wretched disappointments and privations of these years in Canada was the constant advance in scientific knowledge and range of mental vision, which was checked, if at all, only during the physical troubles of the last six months" (Life).

Gosse had changed during this time from a bug collector into a naturalist whose greatness the future was to reveal. More immediately, and very important, the experiences in Canada gave materials for his first book, not now far off. Without it, it seems unlikely that Gosse would have found a foothold in the scientific world.

As indicated, Gosse left Canada almost empty-handed. His precious insect cabinet, made according to his wretched design in Germany while he was at Carbonear, had to be left behind to follow by uncertain means of trans-

¹ Apparently Linnaeus' *Systema Naturae* was his sole scientific reference.

portation. He went down the Hudson on a steamer, didn't even buy lettuce in New York, and hurried on to Philadelphia on the first railroad train he had seen. In Philadelphia he somehow overcame his bashfulness toward strangers and there made his first contact with scientists. Titian Peale, the zoological artist, admired Gosse's drawings of Canadian insects, the great Thomas Nuttall was kind to him, and years later Joseph Leidy (then only sixteen) recalled seeing him. Probably he was such an Ichabod Crane that he attracted attention! Gosse was invited to an evening meeting of the Academy. The stage setting was spectacular.

"The society and its visitors sat around a table in the great hall of the museum, candles dimly and ineffectually lighting up the scene. In the gallery, just above their heads, sat the skeleton of a murderer riding the skeleton of a horse, the steed galloping, and the ghastly rider flourishing his uplifted hand with an air of great hilarity" (Life).

Someone suggested Alabama as a place to go to, and Gosse left for Mobile on a small schooner, the White Oak. It was not a luxury liner, in fact it was so inexpressably dirty that poor Gosse had a hard time, not daring to look at the food he ate, and spending as much time as possible on deck. The captain and crew were still at war with Great Britain and Gosse didn't feel as welcome as a paying passenger might expect to be. The trip to Mobile took about a month.

He left Mobile the same day, going up the river by steamboat. On it he struck up an acquaintance with the Hon. Chief Justice Reuben Saffold, who happened to be looking for a master to teach school for his sons and those of his neighbors, and who offered the place to Gosse. Accordingly, Gosse left the steamer at King's Landing and walked to Dallas, where his school was. Life in rural Alabama was much as it was in most of the young United States, once one got away from the seaports of New England or the tidewater areas of Virginia and the Carolinas. Gosse's *Letters from Alabama*, published 21 years later, give a picture of rural

America quite familiar to any one who knows our early history as a nation. In spite of his three years of Canadian experience, he didn't like it any better than had Mrs. Trollope a decade before or Charles Dickens some five years later.

The school teaching was successful, for Gosse was a stimulating teacher, and he got along well with his students. He made his log cabin serve as well as Mark Hopkin's famous log later on. His enthusiasm for natural history was infectious and soon his pupils were bringing him the usual specimens. He enjoyed his nature walks. Some aspects of the rural social life interested him. During this time he felt a call to be a Wesleyan minister and did a little backwoods preaching. The slavery question was in the air, his associates were touchy and suspected him of abolitionistic tendencies, and there was some strain. Gosse was convinced that his trunks were surreptitiously opened and his letters read.

He left suddenly, silent as to the reason. He had been sick with malaria, his mind more morbid than usual. In Mobile he found his insect case in a warehouse, and was delighted to find the contents in fair condition. After a week's wait for a passage to England, he left on the Issac Newton the first week in January, 1839. He left Alabama even poorer than when he left Canada. Apparently he had nothing but his damaged insect case, some twenty bird skins of some rarity, and a few fur pelts. Anyway, after having paid for his passage, he had so little that upon reaching London he sold his skins to get enough money to get home. Later on the insects sold at a better price. During the trip home he began the habit of discussing the state of his associates' souls, and preached to the crew on Sundays. Even the captain, a professed infidel, listened respectfully. Most important, on this trip home he began his career as a professional author, spending the five weeks of the voyage at his manuscript of the *Canadian Naturalist*, and finished it as far as possible at that time. As indicated, "the rolling stone returned to England, after an exile of eleven years, with practically no moss whatever on its surface."

The time between 1839 and 1844 found Gosse desperately trying to establish a foothold in anything at which he could make his bread and butter. He declined an offer to make him a curator of some obscure museum because of the long hours. He tried to be a Wesleyan minister, and did a little preaching. Apparently, however, backwoods preaching, Alabama style, failed to find a receptive ear in England, and his application to be received as a ministerial student was rejected because of his advanced age—he was thirty years old! The summer of 1839 was ebb tide in his fortunes. He even tried teaching flower painting but nearly starved. He showed his manuscript of the *Canadian Naturalist* to his cousin, Thomas Bell, dentist and naturalist, and ultimately professor of zoology at King's College. Bell recommended it to Van Voorst, the publisher of so many fine works on zoology, and ultimately poor Gosse called to find what Van Voorst's decision was. And when the latter said, "I like your book; I shall be pleased to publish it; I will give you one hundred guineas for it," poor Gosse broke into hysterical sobs, and the dismayed Van Voorst hurried to get wine. I wish I knew whether or not Gosse drank it. The *Canadian Naturalist* came out the following year and was favorably received. It had a freshness and showed "picturesque enthusiasm, the scrupulous attention to truth in detail, the quick eye and the responsive brain, the happy gift in direct description," (Life), which marked his later works.

During this unhappy period he attempted to return to the Southern States to again teach school, which indicates that maybe it wasn't as bad there as he had thought. He renewed his study of Greek and became, in Edmund's opinion, "a fair Greek scholar." He took a "School for Young Gentlemen," at which he was successful, excepting that as his students graduated he failed to find new ones and he finally ran out of students. He did some preaching for the Wesleyan Society, but in 1843 he formally severed his connections with Methodism and joined what became known as the Plymouth Brethren.

The Society for Promoting Christian

Knowledge wanted a popular work on zoology, and having been suggested both by Thomas Bell and Van Voorst as a suitable author, Gosse was invited to prepare it. This, the *Introduction to Zoology* paid Gosse a very welcome 170 pounds, and best of all, pointed to a way of making a living which ultimately solved his major problem. The preparation of it took him to the British Museum, where he made acquaintances which in some cases became long time friends. Among these were Ed. Newman, Ed. Doubleday and Henry Doubleday, Baird, Whymper, Westwood, Adam White, and John and George Gray.

Whymper suggested a book on the ocean, which Gosse wrote in 1844 and which was published the following year. This paid him 120 pounds. It was popular, had a wide circulation, and was better written than the *Canadian Naturalist*. In *The Ocean* he discussed the littoral fauna and flora of Great Britain, the beginning of a subject which occupied much of his time and thought for many years, and which resulted in several books, popular and technical. *The Ocean* was well illustrated by figures drawn both by Gosse and Whymper, the latter a prominent water color painter and engraver who illustrated many scientific works of his time.

Ed. Doubleday suggested that Gosse would find collecting tropical insects worth while, and he found that the British Museum has very little from Jamaica. Looking into the possibilities, he got useful suggestions from Hugh Cumming, a dealer in Gower Street, and a visit to Kew Gardens for information about tropical plants established a life-long acquaintance with Sir Wm. Hooker. He finished a pot boiler, *Glimpses of the Wonderful*, and late in October of 1844 Gosse sailed for Jamaica.

Gosse enjoyed this sea voyage, even describing a flying fish seen along the way as a new species, and reached Jamaica on Dec. 5, 1855. Within a few days he was settled at Bluefields, in the home of Mr. and Mrs. Coleman, Moravian missionaries, and here he stayed the following eighteen months.

Using Bluefields as a base, he ranged over what parts of the island he could reach, observing and collecting—orchids, insects, and birds. His ministerial tendencies resulted in his preaching alternate Sundays at a coffee plantation called Content, some 15 miles east and high up in the mountains. He found Jamaica most unsympathetic toward scientific work, and not until he made a trip to Kingston and met a Mr. Hill did he find a fellow naturalist. The two made a check list of Jamaica birds, some 184 species. This was aided by the use of a manuscript in five folio volumes a Dr. A. Robinson had written about the middle of the 18th century, the contents of which Gosse said was in "specific descriptions, admeasurements, and details of colouring are executed with an elaborate accuracy of a period far in advance of that in which Robinson had lived." Returning to Bluefields after an interval of three weeks, he must have found the life there too much for him, for he suddenly decided to leave. In the middle of June he took a sloop for Kingston, had another good visit with Hill, and sailed for home on July 9, by way of San Juan, St. Thomas, and the Bermudas. On this homeward voyage he developed brain fever and was dangerously ill for a fortnight. By August 6, 1846 he had landed and was on the way to London, his collections intact, and in good shape, even the live birds. Out of this successful collecting trip came his *Birds of Jamaica*, with a nice appreciation to Mr. Hill, the later *Illustrations of the Birds of Jamaica*, and *A Naturalist's Sojourn in Jamaica*.

The years 1846 to 1851 were a bitter struggle for existence, apparently a whole pack of wolves were at the door, hungry and determined. During this time, and in addition to the books just mentioned Gosse produced *The Monuments of Ancient Egypt*, *The Mammalia, Birds, History of the Jews*, the *Handbook of Zoology A Textbook of Zoology for Schools Sacred Streams*, and *Fishes*. Even though part were based on papers previously published in periodicals, it was eleven books in five years! This was a prodigious amount of labor—the sheer writing of that many words was a physical burden, to say nothing of the many other aspects

of authorship. The Jamaican books were based on his personal field work and are scholarly; the various other zoological works had to be hack work compilations, and I personally suspect that the *Ancient Egypt* and the *History of the Jews* would have been better had he known anything about the subject matter. Such books at least put food into his mouth and perhaps, as we loosen our belts and reach for another helping, we can at least be tolerant. It wasn't too long after Dr. Johnson and Dr. Goldsmith!

He broke under the strain, and temporarily abandoning both London and the Society for the Promoting of Christian Knowledge, he went to Infracombe to rusticate, Gosse-like fashion. During these years (1852-1856) he must have convalesced in a leisurely manner, practically abandoning literary work. At least we can suspect it—all we find to account for these years are *Assyria*, *Mollusca*, the fine *Naturalist's Rambles on the Devonshire Coast*, *Popular British Ornithology*, the *Aquarium*, a *Handbook to the Marine Aquarium*, *Kew Gardens*, and a *Manual of Marine Zoology*! That's a mere nine works in four years, two of which were in two volumes each.

During this interlude and as some of the titles indicate, he became intensely interested in marine life, and from this some of his best work resulted. His enthusiasm was infectious, and he organized a "Marine Natural History Class" in 1855 at Infracombe, composed of "ladies and gentlemen" who oh!-my!-ed their Victorian ways along the seashore, collecting and identifying their finds under Gosse's guidance. Imagine a random assortment of pictures out of Godey's Lady's Book come to life, with Gosse, a natural Ichabod Crane, in wide flapping hat, a long flowing coat with sundry pockets buldging with bottles, hip boots—a figure lean and gaunt, marked in the face with the deep lines of mental conflict and physical sickness—at the head. To complete the picture you must add "the little naturalist," Edmund tagging along in his petticoats. Gosse's books of this period carry advertisements of the class. In spite of his efforts the adventure failed during the subsequent years.

The aftermath was unfortunate—a devastating horde of amateur collectors fell upon Britain's shores and depopulated parts of the coast. Even Gosse was put into his place by an English matron. He met her on the coast, disagreed with her identifications and was informed that she had reached them with the aid of Mr. Gosse's book. He held his peace.

Gosse had met the first Mrs. Gosse at a meeting of the Plymouth Brethren. She was then 43 and like Barkis, Gosse proposed in September and married her in November of 1848. Life with him wasn't all bliss—he wanted no visitors—just silence and intellectual activities. She became the mother of Edmund, apparently a mere incident at the time to Gosse, who noted in his diary, "E. delivered of a son. Received green swallow from Jamaica." She died of cancer when Edmund was about seven. The latter's *Father and Son* is a vivid account of his growing up under the well meaning care of what must have been the least fitted man in the British Isles to rear a child. In Edmund's opinion his mother kept Gosse openminded and that with her he might have accepted evolution. Gosse never regained his energy after her death and he withdrew even more from the world. The *Memorial of the Last Days on Earth of Emily Gosse* was his final public tribute to his first wife.

In 1860 Gosse married a second time, and this marriage, since the second Mrs. Gosse came into a comfortable inheritance, allowed him to ease up, to begin to indulge in those matters dear to the successful Englishman of the time—a comfortable house and garden, an attached orchid house (Mrs. Gosse noticed how much more comfortable their house was after Gosse began growing orchids), and to indulge himself in botany and astronomy as hobbies, to which the marine aquaria were added.

The experiments with the marine aquaria were the result of the years at the seashore, developing naturally from the desire to have some of the organisms where they could be studied more carefully and fully, freed from many of the shore's distractions. Gosse found

that Robert Warington, of Apothecaries' Hall, was also experimenting with aquaria, but using freshwater organisms. They got along well, with no dispute or unfriendly rivalry. This was not the case with the Zoological Society. Gosse began to stock aquaria at the Zoological Gardens in Regents Park for the Society. They were a financial success and apparently the Society wanted to maintain a monopoly, and when Gosse began to stock other aquaria, such as at the Crystal Palace, a quarrel arose. There had been no actual contract or pledge binding Gosse exclusively to the Society. It caused a breaking off of relations, and Gosse turned more to his private aquaria.

Gosse now began to be well settled after his years of hardship. A wife with a modest income, a home beginning to be patterned according to his needs and desires, a fair return from those of his books which caught the popular fancy (the *Aquarium* paid him 900 pounds), and best of all—the very life blood of a scholar—the contact and friendship of his peers, Richard Owen, Darwin, Edward Forbes, C. Spencer Bate, Bowerbank, Huxley, Charles Kingsley, etc. Honors had begun to find him—Associate of the Linnaean Society (1850), Royal Society (1855) with Lankester as his proposer. Gone from his title pages was "Cor. Mem. of the Nat. Hist. Soc. of Montreal, and of the Lit. and Hist. Soc. of Quebec," which lent respectability to the Canadian Naturalist. Gosse had arrived, and the F.R.S. after his name was as good as the "sterling" on his silver. The successes and honors had their effect. *Tenby* (1856) wasn't as successful—the Saturday Review objected to "Mr. Gosse's air of taking us upon his knee like a grandpa," an attitude I suspect was developed by his teaching and perhaps more by the series of popular lectures he gave for years. Edmund thought that the public was tiring of Gosse, that his style and subject matter were no longer as fresh and novel as they had been a few years before. And, as any writer knows (ask Miss Carson!), poachers began to work his private territory, and doing well at it. Even his good friend Kingsley wrote *Glaucus, or the Wonders of the Shore* (1855). The Oh!-My! field requires constant

change and does not thrive upon mere cultivation.

The year of his second marriage saw the publication of his great work on sea anemones, *Actinologica Britannica* (1860) and also of the first volume of *The Romance of Natural History*. Edmund thinks the latter is the one of Gosse's numerous publications which comes closest to being an English classic. It included a chapter on the sea-serpent, which Gosse thought was a plesiosaurus, and which stirred up a furore which has never died down completely. My copy has several press clippings of the time inserted, positive eye-witness accounts showing fervor and certainty. The following year he brought out the second volume of *The Romance*. Poor Gosse, pleased with the sensational response to the sea-serpent, tried again, this time with a chapter on mermaids. The public wasn't interested. Edmund says, "We feel that the first series was produced because the author had something which he must say, the second because he must say something." This almost completes the tally of books. Gosse settled down, indulged in new hobbies or revived old ones as the spirit moved him. A series of articles to a popular magazine resulted in *A Year At The Shore* (1865), which was the last of his zoological volumes except the rotifer volumes. His last actual volume seems to be *The Mysteries of God* (1885).

From 1864 on to the end of his life Gosse was withdrawn from the world, apparently visiting London only once in the last 15 years. During these years he lost and regained interest in his old time subjects. For a time his interest in the marine aquarium revived and he built an elaborate one with a clever circulating mechanism which required attention only once a week, and even at the age of 67 would strip to enter cold tide pools to get specimens. During this time his interest in insects was renewed and he collected butterflies of the world, working with dealers, and at the age of 72 began a monograph on the reproductive organs of Lepidoptera which took him two years to do. It was published by the Linnaean Society after an unexpected difficulty arose and was circumvented. Gosse had added to his

monograph a paragraph of his customary pious remarks. The society objected and asked him to remove them. He refused, preferring not to publish the work, even though his elaborate plates, expensive to publish, had already been done. Lankester solved the tense situation by having it pointed out to Gosse that if they allowed him space for defending Christianity, they might sometime be requested by an atheist for an equivalent amount of space for attacking Christianity. This specious reasoning impressed Gosse and most unwillingly, he agreed to its removal.

The greatest of his work came last. He had bought a microscope in 1849 and in that year first became acquainted with rotifers, an interest in them developed which lasted the rest of his life, some forty years. During this time he published a few papers on the group, but for so prolific a writer (I have omitted reference to most of his technical notes and papers for lack of space), he really published relatively little on rotifers. Dr. C. T. Hudson had begun his studies on rotifers in 1867 and was working towards a definite monograph upon them when, in 1879 Lankester suggested that he get in touch with Gosse about the matter. Doing so, the two were attracted to each other, struck up a close friendship, Gosse placed all his work at Hudson's disposal and the two worked together joyfully. *The Rotifera* (1886) in 2 volumes was regarded by Gosse as his final scientific work. When members of his family objected to his appearing as junior author, he replied:

"Your judgment will probably be modified, when you are better acquainted with the facts. My position on the title-page was the subject of much discussion by Dr. Hudson and me, and I chose decisively that 'Assisted by P. H. Gosse' should be the mode, *contrary to his wish*. He has, throughout, been most lovingly considerate of my wishes, and only too ready to put me into prominence and honour. The labour, the plan, the publication, all the drudgery, have been his; so that to put his name prominent is only the merest justice . . ."

Gosse thought he was all through, but

Hudson got him to help on the supplement, including sixty new species discovered by Gosse since the work appeared. Gosse did not live to see this

supplement. He died August 23, 1888, a little over 78 years old; the sturdy heart finally faltering and at last quitting.



The Urban Institutions

Because of the closeness of the urban institutions to the people, to the institutions they serve, the businesses and industries, it seems to me that they are presented with a rare opportunity. If they are so convinced, they can take the initiative in declaring for those fundamental values which lie in freedom of speech, freedom of thought, freedom of worship, freedom to dare and freedom to work. We must cultivate anew the idealism which is America, which accounted for its founding, and has been the source of its strength.

I believe that urban institutions, by virtue of the fact that they go to the community and ask how they can best serve its needs and desires, are in a strong position to promote the appreciation of our freedoms on a mutual, community-wide basis.

In the identification and appreciation of the fundamental freedoms, this nation requires the support of all segments of our society. From experience, urban institutions have become sensitive to the needs of businessmen and have gained understanding of their problems. This understanding provides an excellent medium through which mutual support of our basic values may be greatly strengthened.

You will recall that a few years ago there was an especially strong attack on an economics textbook on the ground that it was subversive. This particular textbook had been widely adopted by reputable colleges and universities and the literature of the attack was directed to members of their Boards of Trustees, who were largely businessmen and industrialists. Be it said to the great credit of those ultimately responsible for the conduct of American education that the deliberations of the trustees themselves eventually resulted in the discrediting of this attack. I have recently had the opportunity to read some of the statements that were made by members of Boards of Trustees about the matter, and their adherence to the basic values of education and to the tenets of justice and freedom filled me with singular pride. This is the type of approach which means certain defeat for those who would undermine our country by undermining education. This is the type of approach we need to discredit the forces of anti-intellectualism which are abroad in this country—Dr. Arthur S. Adams, President, American Council on Education.



SCIENCE

By the late EDWARD ASAHEL BIRGE

DELIVERED AS A PART OF THE SEVENTY-SECOND
COMMENCEMENT OF THE UNIVERSITY OF WISCONSIN

MADISON, JUNE 21, 1925

(When Dr. Edward A. Birge, distinguished limnologist and honorary member of Phi Sigma—Zeta '24—held the presidency of the University of Wisconsin, it was his custom to deliver the baccalaureate at each commencement. "The Biologist" is indebted to his third successor, another biologist and honorary member, Dr. Edwin B. Fred, Zeta '26, for his gracious permission to reprint a message which by virtue of the circumstances under which it was given, was destined for far too small an audience. In a time of world-insecurity and trouble, it seems appropriate to make it a permanent part of the Phi Sigma record.)

Sicut Granum Sinapis

This is the ninth baccalaureate address that I have given at our Commencement. In each of the others I have discussed some question of the University or of education or of college life. You will then not think it strange that I employ this last official occasion to talk on a subject which indeed deeply concerns university life, but which I shall consider from a more personal viewpoint. For I wish to talk of science as it has been an inspiration and a hope in my own life rather than as a means of education or as indispensable to society.

The teachings of our Lord, however new and surprising to the hearers, seem ordinarily to have come from Him almost as matters of course carrying their own freight of meaning to those who had ears to hear, but not heralded or proclaimed with special emphasis. But on one occasion at least He uttered what seems to have been for Himself a new thought, worthy of an unusual and emphatic introduction: "Whereunto shall we liken the kingdom of God or with what comparison shall we compare it?" Let me assume your ignorance of the answer and put this question directly to you. The kingdom of God, that is, the rule of God among men, the divine order realized here on earth—what is it like, to what will you compare it? Take a moment to consider your answer.

How long should we have to wait before your own wisdom returned our Lord's surprising answer? "It is like a grain of mustard seed—when it is sown, it groweth up." And now that the answer is thus given to you, what do you see in it? What do you see in other similar comparisons, such as the parable of the sower, of the leaven, of the seed growing secretly? Have you learned from them the fundamental truth that the kingdom of God is like a natural product, and that the laws of its development are like those of all natural processes? Have you learned that if we are to read the story of the kingdom of God aright we must guide our understanding with the aid of the processes of nature?

If you see this truth, then you university students of today are more fortunate than your predecessors in other countries. For while much of the traditional thinking about the kingdom of God rests on those parables of our Lord which deal with men, very little of it has been based on those which deal with nature. This was inevitable; for men must understand nature through long and sympathetic study before they can appreciate its relation to thought and to conduct. So it befell that for many centuries the mustard seed was not only neglected but almost forgotten. Indeed, one may say that for a thousand years western religious thought increasingly ignored any com-

parison between the processes of the kingdom of God, as they understood it, and those of the natural world. Men emphasized that which they regarded as supernatural as the significant activity of God, and they likewise brought to the front those powers of man which seem to separate him from nature—to raise him above it, as they said. And even now men not seldom believe that the development of the kingdom of God moves along lines not at all comparable with those of the mustard seed.

So in the Western Church of Europe and in western universities, there were gradually wrought out and perfected wonderful systems of thought. They constituted a revelation of the kingdom of God as seen in the light of comparisons based on human personality, a revelation far greater and clearer than men had ever received before. And like all revelations it was given to the world by "the hand of mediators" laboring through many centuries, from St. Augustine to St. Thomas Aquinas and Duns Scotus, and not unworthily continued by John Calvin.

Out of this revelation of the "eternal truth" there were slowly built, like the great cathedrals, noble homes for the human spirit, temples for the worship of God. The Eastern Church wrought out its conceptions of the divine nature into formulae at once far-reaching and accurate, built in strength and beauty as St. Sophia's complex of domes was poised in air and adorned with color and mosaic. Western thinking about the kingdom of God left its primitive simplicity just as it exchanged the basilica for the magnificent solidity of the Romanesque. Later still came theologies and philosophies which emulated the architecture of the Gothic cathedral, daring and restless, thrust of lofty arch balanced against resistance of buttress with exact counterpoise. And finally there came the stark directness of Calvinism, each part shaped and united with its fellows into an intellectual system, firmly proportioned like a steel-framed structure.

So these successive revelations were wrought, as each of their authors believed, into consistent completeness. But they were all to hear again, and

in a new sense, the words: "God that made the world and all things therein, seeing He is Lord of heaven and earth, dwelleth not in temples," even though they had been made not with hands but with reverent thinking. For there was to come another lesson in the age-long process of education—that offered by the long-neglected parable of the mustard seed as newly presented in the new revelations of science.

At first the lessons of science seemed to bear little likeness to a divine revelation either in origin or content; indeed many of them were far removed from anything that the word *science* brings to our minds today. They seemed—they were—trifling in comparison with the great theologies. They might rather gratify curiosity than afford either intellectual constructions or moral guidance.

But little by little facts came together, and as they united they disclosed what were called laws. The regular structure of the kingdom of God, the order of nature—which had always been recognized as a part of man's environment—slowly enlarged and began gradually to include all about him. Things fitted together, not merely in an ideal sort of way, but, as it seemed, really and in truth.

Thus a new structure of thought began to take shape in its turn. Science came into being as a construction and it developed not only a place in which human thought might work, but a home where the human spirit might live, a temple where it might worship. As generations and centuries passed, ever-widening discovery brought not merely new knowledge but material for a more complete structure, for more far-reaching laws.

Turn for a moment to one example out of hundreds and see how within the short memory of you who graduate tomorrow, science has brought not mere additions to knowledge but a wider sense of the structure and operation of nature.

Only last Christmas* there was announced the first measurement of the

* AAAS, Dec. 1924.

distance between our world and a second universe of stars, the nearest neighbor perhaps to that universe of which our solar system is an insignificant member. We may call it neighbor, but it is so far off that a million years have passed since the light by which its distance was determined started on its journey through space. When the light by which we may see it tonight left those stars in Andromeda, no human eye perhaps had yet appeared on earth. Mountains have risen and fallen, again and again has ocean invaded the land and been forced back to its former bed; great continental glaciers have developed and plowed their way south, have retreated and advanced and retreated again—over and over has the surface of our earth been remodeled and repopulated while this beam of light has been coming to us for measurement. And this other universe, so inconceivably distant, is only one of our neighbors, perhaps the nearest of those universes whose numbers are still beyond count, but which are known to exist not “as single spies, but in battalions” of many scores of thousands. Has any event in history brought a greater enlargement of man’s conception of the construction and operation of the universe than comes with this single observation?

Or turn to the other end of the scale—to the change in our ideas of the construction of the atom and of the evolution of chemical elements which results from the discovery of the electron. Here, as in the former case, is not merely an extension of knowledge—not merely new and interesting facts learned—but a vast enlargement of our conception of the framework of nature and of the way it has developed. And these discoveries from the two ends of the scale unite with each other to disclose one law and one pattern throughout the assembled worlds. From atoms to universes we find, not that “dead matter” of which I used to hear in my youth—dead except as it is acted upon by external forces—but a constant flux of energy always and everywhere present in all things, shaping itself anew from hour to hour, as it does from age to age.

So it is also in matters which concern more immediately the relation be-

tween man and world. There has been an enormous increase in our knowledge of the interpenetration of human life and activity by the forces of the world about us. We know today, with a new fullness and accuracy, how our physical and emotional operations are controlled through the nervous system associated with consciousness, and we also know that there are innumerable chemical controls whose presence and importance are augmented by almost daily discoveries. We have found too that there is a vast region of unconscious mentality, out of which will and feeling and thought emerge into the light of conscious activity. Thus in important respects man is learning not to correct his knowledge but, what is more significant, to reverse his feeling, his attitude, toward the world. So far from attempting to detach himself from the larger world and to look at himself as in some way independent of it, man is coming to see that he is himself in a very real sense an integral part of creation; that his powers and possibilities are the personal expression of those inherent in creation; and at last he is beginning to catch a faint glimpse of the lesson, repeated over and over to deaf ears through centuries of teaching, that man in the fullness of his powers is the son of God the Creator—of “God that made the world and all things therein.”

Thus there is far more in these discoveries than additions to knowledge—new and larger facts are the smallest part of them and of the countless other revelations of science. Through them there has been at least partially completed the sketch of the framework of things; something more than a hint of the interrelated life of the world, which Newton’s *Principia* began to reveal. This result has been reached not by guesswork nor by intuition of the mind projected beyond knowledge, but by discovering the measurable operations of the world, by ascertaining how they fit together and constitute, through their combined action, an active and living universe.

This is one side of science, the side to which four centuries have brought the greatest development. But these revelations have another and even

more important side. Science is beginning to reveal not only the structure and working of this part of the kingdom of God but also its history; and if we date our definite ideas of its operation from the 17th century with Newton's *Principia*, we must come down a century and a half to find a similar date for our conceptions of its history. For less than a hundred years ago Lyell made effective in the realm of thought the doctrine of uniformity as applied to the life of the earth, and thus began to write its history in terms similar to those of human history. His predecessors had looked to convulsions and catastrophes for the origin of continents, mountains, and oceans. Lyell's conception of the movement of this part of the kingdom of God was quite unconsciously akin to that underlying our Lord's parable. "If you want to know how the world was made," he said, "go to the brook, to the seashore. Consider the working of rain and sun and wind. Earthquakes and volcanoes play their part with the rest, but the story of the world is not the story of amazing events suddenly precipitated but of the long and slow action of forces now operative about us." Can you not see that behind this conception lies the same insight into nature as that which told us that the kingdom of God is like a mustard seed which when it is sown grows up?

Here, then, a new way of looking at things emerged into the full consciousness of thought—a revelation new in its vigor and efficacy. Science had first assembled the facts of the world, much at random and in helter-skelter fashion. Then it had gradually seen that they were integral parts of a structure. Later it was realized that the world was an operating affair, an organized and going concern, with its own methods and laws. Now there was added the full conception of a past and a future, of an historical development, of an evolution which could be read in the light given by present operations, just as the laws of the kingdom of God may be found in the growth of the mustard seed.

With this idea as a clue a new and limitless field was opened to science, a field which it has only begun to ex-

plore, whose extent is even yet unknown. But the short century since 1830 has seen advances into it along certain lines. For just as Lyell was completing his *Principles of Geology*, Darwin was beginning his studies on the species, and twenty-five years later he was to apply to that side of the problem of life the same fundamental principles that Lyell had applied to the history of the earth. Darwin told us that if we want to begin to know how species have come about, we must look first to the pigeon house, to the barnyard, to the grain field, and see what forces are operating there. Here are processes to be followed out; here is an evolution of forms, and the forces behind it are not those exercised suddenly by the intervention of unknown and incalculable energies; they are those now at work in the world about us. To this world as a present going concern we must look if we are to understand its past, knowing that out of the past the present has come. The kingdoms of life in all their multiform greatness are expressions of the same forces and laws that determine the growth of the mustard seed.

Thus the lesson of history is beginning to take shape. The guesswork of the past was not seldom foolish, but it was often surprisingly wise and acute. What recent generations are contributing is not new and wiser conjectures, but the slow writing of history, page by page, chapter by chapter, as the story is revealed. No page is finished beyond correction, no chapter even half written as yet. But men have learned that there is a readable history just as they once learned that there is a measurable operation. When that lesson has been learned new pages are turned, new chapters opened. And almost within your own college days the clear and direct challenge has come to science to begin to write the story of the evolution of the chemical elements—the stuff out of which worlds and men are alike made.

Thus through the aid of science the parable of the mustard seed is at last coming into its own after nearly nineteen centuries of waiting. Look where we may—consider universes or stars, or turn to atoms and to elements; study

the earth as a planet or as a structure; look to oceans and continents; trace the development of their living inhabitants; or, finally, read the history of man in structure and powers—one law appears, and one event. We may phrase it as we will, and its expression will vary according to the precise nature of the revelation that is given and according to the temper of him through whom the revelation comes; but beneath all variation there appears, as fundamental to the movement of the entire kingdom of God, the law which our Lord found in the mustard seed—"it groweth up." The universe in every part from least to greatest is moving by an inner life; it has grown; it is growing. It has powers and potencies which come into action according to opportunity. They find constant expression in a development after their own kind, according to their own capacity, to ends ordained in them and decreed in their own construction. This is the revelation of the law of the kingdom of God, operative in all parts of that kingdom, a law whose disclosure has come gradually during the past four centuries, as men have discovered nature, and whose full scope and significance are beginning to be revealed to our own day.

Thus we, who have faith in the broad kingdom of God as a developing fact and a working power among men, see nothing strange or surprising in the history of science during recent centuries. To learn this new lesson has been the allotted task of these generations, as it was the task of thinkers in early Christian centuries to formulate creeds, and, in later ages, to work out a scheme of the moral administration of the world or to bring together Greek and Christian philosophy. Through all the slow lapse of time we see the growth of the "eternal truth," to which each century adds a little and which each thinker serves in his own way, as cell or leaf serves the plant. And we are sure that the processes of the past, whose results are now apparent, are operative in the same way today and with the same certainty of continued advance.

So we find in science a new revelation of the kingdom of God, a revela-

tion whose nature was fore-shadowed in the parable of the mustard seed. Like the parable, this revelation does not attempt to cover the whole of life. It is directed primarily to thinking rather than to conduct, just as theology and philosophy are addressed to thought. Its immediate purpose is to enlarge knowledge and therefore of all its results the most certain is that "we know in part." It moves on and changes under the operation of these forces which brought its present state into being. Indeed the disclosure of this movement is a far more important revelation than is any other discovery.

But science, like theology or philosophy, brings understanding along with knowledge. Men may indeed employ these results of science wisely or unwisely, as they have used or misused all earlier revelations. But as years pass, the eternal truth in every revelation of the kingdom of God asserts its power to control not only the thinking of men but also their conduct and their inner lives.

Out of these revelations of the life of the world comes new light for man, illuminating both conduct and thinking. Such results come slowly, as practice always lags behind theory; but so far as conduct is concerned the situation is obvious. Science has already taken control of large and increasing areas of our daily life and conduct. In ways innumerable science is remodeling our environment and thereby changing our actions. Nor has its influence failed to secure an increasing control in those parts of life which do not necessarily change with environment, such as the ways of health, of government, of social organization, and of social conduct. Along all of these lines science has found solutions for certain ethical problems and has created other new ones.

Let us, however, turn from these to look at the far more important and fundamental influence of science on human temper—on man's attitude toward the world about him. That influence is only beginning to assert itself, but it is none the less plain.

Science is teaching men to look for a progressive revelation, to expect from

nature new truth, which will call for change and reorganization of former truth. This attitude is nothing new in theory, but it is very far from old in practice, even for individuals. And as present on a large scale, as held by many thousands of thinking men, it now reveals a new and surprising temper and leads to surprising results. Men's eyes are turning to the coming day—to a developing world—as never before. Science inevitably looks to the present and future, to a world unfolding before our eyes—the mustard seed growing up out of the ground. It is sure that the world is “fresh every morning,” and that the assurance of the newness requires only eyes to see. It is equally certain that its newness is the natural product of its oldness, that it results from growth, from the new expression of internal powers.

It has always been easy for men to see that the revelations to generations behind them were partial in comparison to theirs—“God having reserved some better thing for us, that they without us should not be made perfect.” We readily grant that the past was not made perfect without us, but it is not so easy for us to realize that we, lacking the future, are also far from perfect. That is a lesson quite different and not so easily learned, either in theology or in any other system of thought. But science has at least partially learned it and is beginning to teach it to all.

Let us name a second great spiritual lesson from science. Through it there has been given at least a glimpse of the eternal evolution of the universe—undisturbed, unhurried, certain—from which in due time issued both world and man. So the words, the “kingdom of God,” have gained a new significance for us, a larger meaning, as we begin not only to see its movement but also to feel in it the rule and the power of a life, stirring and asserting itself in ourselves and in all that is about us. Long ago this came to faith. Now it is being disclosed to vision and vision challenges new faith. It is no modern teaching that man sleeps and rises, night and day, and the “seed groweth up, he knoweth not how.” So is the kingdom of God, as the message

told nineteen centuries ago; but how many during these centuries have really felt it true that in theology, in religion, in science, “the earth bringeth forth fruit of herself?”

On the contrary, men have found it easy to lapse into disheartened indifference and idleness in the face of so much in the world that needs improvement or cries out for reform. Many, too, have not found it hard to urge progress by over-hasty legislation, by force, even by persecution. “He that hath faith shall not make haste,”—is a saying that reformers have not found easy to believe. Their faith has ever pressed with eagerness toward its results and, of all trials of constancy, waiting has been the hardest to endure.

But as science has taught us to interpret the movement of the world in terms of history, it has become less difficult to retain faith and still see that this movement can not be hurried; that our efforts, if they are to succeed, must move with the current of things; that we can play a useful part only as we join ourselves to that greater movement in which we are ourselves involved.

Men think and write of the necessity of “humanizing science,” and in certain ways and in certain senses the phrase is just. But those that urge it too often fail to see that the fundamental lesson for our day is quite the reverse, that it calls for the “scientizing of humanity.” Men are observing the movement of the world; in some degree they are learning to know the forces that operate it, to perceive their direction and rate. But how far they still are from feeling that movement as part of their own consciousness and accepting it as the basis of their own action! Until “the wind that blows between the worlds” has become the breath of our life, in consciousness as well as in fact, we have not realized either our possibilities or our duties as the heirs of the Creator. Toward that realization the revelation of the kingdom of God in nature is slowly guiding us, and from science too we learn that “we are saved by hope,” as is always true of the purpose and results of revelation.

Thus I have named two of the present spiritual results of the revelation of science—results still very imperfect, but after all present in so great a degree that we clearly perceive their presence and may forecast their future. And there is another consequence of this revelation, far less plainly visible, but which appeals to me even more than these partly because it belongs almost wholly to the future although its basis is in a revelation of today; and partly because I see in it a possibility of resolving one of the most inveterate difficulties of religious thought.

Few distinctions have been more fundamental in religious thought than the difference—the opposition in essence and operation—between matter and spirit; few more influential in science than that between matter and energy. The recognition of these differences seems to have been forced upon thinkers rather than sought by them. On the contrary they have looked for some reconciling point of view.

If we accept the parable of the mustard seed in its fullness we must recognize that such a reconciliation is present in the fact if we can only find it. The kingdom of God is the kingdom of an omnipresent life everywhere expressing its own powers. Therefore we need not accept as final that conception of the world of matter as a sort of inert stuff moved only by a world of higher forces external to it and in a sense separate from it. In the same way, we need not conclude that man shares two irreconcilable natures derived from diverse worlds and that it is at once his duty and his privilege to escape from the world of "dead matter" into that of "living spirit."

For these ideas demand reconsideration now that all the world of matter that we know is seen to be a form of energy. "Inert matter" stands revealed as part of the world of activity, and in the light of this revelation old questions call for new answers. When inertia has become one of the functions of a universal energy, then matter in the old sense has disappeared. How shall we state anew the contrasts between matter and spirit in religious

thought now that one of the opponents has been eliminated?

The nature of the answer still belongs to the future, but the feeling that such an answer is demanded is not a matter of modern times. For as we have found our text for the day in the Bible, so we find there also recorded a deep intellectual distress underlying the words in which St. Paul sums up this antagonism.

Have you tried to work out into clearness his ideas, hinted at rather than expressed, pressed from him by spiritual necessity rather than produced by vision? The whole creation—he tells us—unwillingly made subject to vanity, is waiting in pain and distress for its deliverance from "the bondage of corruption." Does not St. Paul here express the necessity, deeply felt but only very imperfectly understood, for the restoration of unity out of the conflict between matter and spirit? That unity is to be restored, St. Paul tells us, by the "manifestation of the sons of God" and the deliverance of all creation into the "liberty of the glory of the children of God."

Does not the conception of matter which is fresh today begin to put a clearer meaning behind the emotion of these words? We are seeing in that matter, which "in our ignorance" we called dead and "covered with approbrium," the direct activity of those eternal powers out of which our own powers have come. The evolution of the universe, from atoms on, is the freedom of God, and there is no larger freedom than His. This movement in its progress and its results is the glory of God, and there is no other glory. We as his children are born of this glory and we may enter into its liberty. This is the lesson, long desired in vain, toward which the teaching of recent centuries has been definitely moving, this the revelation whose half understood beginnings God's messengers are reading today.

And as we find in St. Paul's words a statement of this old and fundamental problem, may we not also look to him for words in which to express the revelation of today—words which

disclose the fullness and the hope of the revelation of science? For to us of the present day there is being made known, as never before, in the writings of the prophets of science "the administration of the mystery which from ages eternal has been hidden in God the creator, but now is revealed to all nations," and like all revelations is set forth "unto the obedience of faith."

I wondered during the singing this afternoon whether there were here any that might be surprised at hearing St. Gregory's morning hymn sung in an afternoon service. It was by no mere accident or oversight that you heard his words:

Ecce jam noctis tenuatur umbra
"Lo the dim shadow of the night is thinning,

Gold-red the light gleams, as the dawn advances."

Do you imagine that Gregory wrote this hymn merely to fit the routine of monastic life? Look back to its date thirteen centuries ago and feel the profound pathos beneath that attempt to find faith for the day. Morning, indeed, brought its light, as always, but what of the light of life, what of the light of that world which St. Gregory tried to rescue? His hymn was written for a Rome which he found "bowed down

by pain unfathomable, by depopulation, by the assaults of the enemy, and by the weight of its own ruins." His life went out in an increasing darkness which settled down into a social and intellectual night; for whose dawn the nations of the West were to wait through half a millennium of confusion and distress. To what other visible source than nature could he turn in order to find a renewed faith from its ever renewed life?

Do not the words still yield a meaning for us whose world is consciously moving toward the light and into the light? For to us science is revealing not only the growing life of the universe, but our own life as part of it. And out of that life there is coming not only a light to guide our feet, but also a light to illumine our hearts. And as we come to that close of your college days, which is in the fullest sense a commencement, we may well feel that every hour of today is "Sunday at Lauds," in which we may give thanks in St. Gregory's words that our years are placed in the morning of a divine revelation.

"Whereunto shall we liken the kingdom of God or with what comparison shall we compare it?

"It is like a grain of mustard seed—it groweth up."



Ownership of Books

I am a bit disturbed when I meet students who seem to have no desire to own books. If one really loves books, he will wish to keep some of them in his own library. Ownership of books is not merely for the purpose of developing a pride in such ownership, but in the retention of books one is consciously providing for the inner self which one builds through the years. Much these days is being said about mental hygiene and frequently we summarize it all by saying that good hy-

giene is the result of that intangible inner self that aids one in crisis periods. Companionship with books and a fellowship with the minds of great personalities help in building an inner reserve to which one can retreat for strength and help. A good library does all it can to help students to appreciate the necessity of retaining their friends who will help them in their darkest hours.—President Charles S. Anspach, Central Michigan College of Education, in *The Wilson Library Bulletin*.



MODERN SCIENCE AND THE EXISTENCE OF GOD

POPE PIUS XII

ADDRESS TO THE PONTIFICAL ACADEMY OF SCIENCE,

NOVEMBER 22, 1951

(At the Council meeting this Fall, the Editor advised with those present as to the propriety of printing this item in "The Biologist." In view of the fact that only one scientific journal caught its historical significance and wider implications (BULLETIN OF THE ATOMIC SCIENTISTS, Vol. 7, No. 5, June 1952) and in the interest of integrated biological education it is presented in its entirety at this time.—The Pontifical Academy of Science dates back to 17 August 1603, which makes it senior to the academies of Paris, London, St. Petersburg or Berlin. It is composed of seventy scientists who hold the honor for life. They are selected without consideration of color, race or creed. Nine Americans have been named to the Academy: the late George D. Birkhoff, Professor of Mathematics at Harvard University; the late Alexis Carrel, Professor of Biology at the Rockefeller Institute; Peter Debye, Chairman of the Chemistry Department, Cornell University, Ithaca, New York; Edward Adalbert Doisy, Professor of Biochemistry at St. Louis University School of Medicine, St. Louis, Missouri; Herbert Sidney Langfeld, Professor of Psychology at Princeton University, Princeton, New Jersey; Robert A. Millikan, physicist, Director of the Norman Bridge Laboratory of Physics in the California Institute of Technology; the late Thomas Hunt Morgan, geneticist and evolutionist, director Wm. G. Kerkhoff Laboratories, also in the California Institute of Technology; George S. Sperti, Director of the Institutum Divi Thomae in the Athenaeum of Ohio; and Hugh S. Taylor, Professor of Chemistry at Princeton University. Among the European scientists who hold or have held membership in the Academy up to 1946 are: Emil Abderhalden, German physiologist; Vilhelm F. K. Bjerkness, Norwegian physicist; Niels Bohr, Danish physicist; Lucien Cuenot, French zoologist; Umberto Nobile, Neapolitan aeronautical engineer; Max Planck, German physicist; Charles Sherrington, British physiologist; Armin Tschernak-Seysenegg, physiologist of Prague; and Alfred Ursprung, Swiss botanist.)

This meeting of the Pontifical Academy of Science brings Us an hour of serene happiness, for which We are grateful to the Almighty. At the same time it affords Us the welcome opportunity to spend some time in the company of a select group of eminent Cardinals, illustrious diplomats, outstanding personages and of yourselves, the members of the Pontifical Academy, who are indeed worthy of the solemnity of this gathering. For, by your research, your unveiling of the secrets of nature and your teaching of men to direct the forces of nature towards their own welfare, you preach at the same time, in

the language of figures, formulae and discoveries, the unspeakable harmony of the work of an all-wise God.

In fact, according to the measure of its progress, and contrary to affirmations advanced in the past, true science discovers God in an ever-increasing degree—as though God were waiting behind every door opened by science. We would even say that from this progressive discovery of God, which is realized in the increase of knowledge, there flow benefits not only for the scientist himself when he reflects as a philosopher—and how can he escape such reflection?—but also for those who share in

these new discoveries or make them the object of their own considerations.

Genuine philosophers profit from these discoveries in a very special way, because when they take these scientific conquests as the basis for their rational speculations, their conclusions thereby acquire greater certainty, while they are provided with clearer illustrations in the midst of possible shadows, and more convincing assistance in establishing an ever more satisfying response to difficulties and objections.

Thus stimulated and guided, the human intellect approaches that demonstration of the existence of God which Christian wisdom recognizes in those philosophical arguments which have been carefully examined throughout the centuries by giants in the world of knowledge, and which are already well known to you in the presentation of the "five ways" which the Angelic Doctor, St. Thomas, offers as a speedy and safe road to lead the mind to God. We have called these arguments "philosophical." This does not mean that they are a *prioristic*, as they are accused of being by a narrow-minded and incoherent Positivism. Even though they draw their demonstrative force from the power of human reason, they are nevertheless based on concrete realities established by the senses and by science.

In this way both philosophy and the sciences, by means of activities and methods which are analogous and mutually compatible, carry on their work. Though in different measures, they all make use of both empirical and rational elements and cooperate in harmonious unity for the discovery of truth.

But if the primitive experience of the ancients could provide human reason with sufficient arguments to demonstrate the existence of God, then with the expanding and deepening of the field of human experiments, the vestiges of the Eternal One are discernible in the visible world in ever more striking and clearer light. Hence it seems helpful to re-examine on the basis of new scientific discoveries the classical proofs of the Angelic Doctor, especially those based on motion and the order of the universe (S.Th., 1 p., q. 2, art. 3), that is to say, to inquire if, and in what

degree, a very profound knowledge of the structure of the macrocosm and the microcosm contributes towards strengthening these philosophical arguments.

It is also helpful to consider, on the other hand, if and to what degree these proofs have been weakened, as is not infrequently affirmed, by the fact that modern physics has formulated new basic principles, ruled out or modified certain ancient ideas, whose content was perhaps judged in the past to be fixed and definitive, such as time, space, motion, causality, substance—all of which concepts are supremely important for the question which now occupies us.

The question then, is not one of revising the philosophical proofs, but rather of inquiring into the physical foundations from which they flow—although limitations of time will oblige Us to restrict Our attention to only some few of these foundations. There is no reason to be fearful of surprises. Not even science itself aims to go outside that world which today, as yesterday, presents itself through these "five modes of being," whence the philosophical demonstration of the existence of God proceeds and draws its force.

From these "modes of being" of the world around us which, in greater or less degrees of comprehension, are noted with equal evidence by both the philosopher and the human mind in general, there are two which modern science has, in a marvelous degree, fathomed, verified and deepened beyond all expectations: 1) *the mutability of things, including their origin and their end*; and 2) *the teleological order which stands out in every corner of the cosmos*. The contribution thus made by science to the two philosophical arguments which hinge on these facts, and which constitute the first and the fifth ways of St. Thomas, is most notable.

To the first way physics, especially, has provided an inexhaustible mine of experiments, revealing the fact of mutability in the deepest recesses of nature, where previously no human mind could ever even suspect its existence and vastness. Thus physics has pro-

vided a multiplicity of empirical facts which are of tremendous assistance to philosophical reasoning. We say "assistance," because the very direction of these same transformations, precisely in view of the certainty afforded by physics, seems to Us to surpass the value of a mere confirmation and acquires almost the structure and dignity of a physical argument which is in great part new and more acceptable, persuasive and welcome to many minds.

With similar richness other sciences, especially the astronomical and the biological sciences, have in our own day contributed to the argument from order such a vast array of knowledge and, so to speak, so stupefying a vision of the conceptual unity animating the cosmos, and of the teleology directing its movements, as to anticipate for modern man the joy which the Poet (Dante) imagined in the empyrean heaven when he beheld in God

"Into one volume bound by love,
the same that the universe holds
scattered through its maze" (Par.
33, 85-87).

Nevertheless, Providence has disposed that just as the notion of God, which is so essential to the life of each individual, can be gathered easily from a simple look at the world—in such a way that not to understand the voice of creation is foolishness (Wis., 13, 1-2)—so also this same idea of God finds confirmation in every new development and progress of scientific knowledge.

Wishing to give here only a rapid summary of the priceless services rendered by modern science to the demonstration of the existence of God, We shall limit Ourselves, first of all, to the fact of changes, pointing out principally their amplitude and vastness and, so to speak, their totality which modern physics meets in the inanimate cosmos. We shall then dwell on the significance of their direction, which is likewise verified by science. Thus, in Our treatment of these points, We shall, so to speak, be lending an ear to a miniature concert of the immense universe, which nevertheless has a voice strong enough to sing "the glory of Him who moveth all that is" (Par., 1, 1).

A. The Fact of Mutability

a) in the macrocosm:

At first sight it is rightly a source of wonderment to recognize how the knowledge of the fact of mutability has gained ever greater ground, both in the macrocosm and in the microcosm, according as science has made new progress, as though confirming with new proofs the theory of Heraclitus: "Everything is in flux": *panta rhei*. As is known, our own everyday experience brings to light an immense number of transformations in the world around us, both near and far away, particularly the local movements of bodies. But, over and above all these local movements strictly so-called, the manifold chemico-physical changes which take place in the world are equally noticeable, as, for example, the change in the physical state of water in its three phases of steam, liquid and ice. We are aware also of the far-reaching chemical effects produced by the use of fire, the knowledge of which goes back to pre-historic times, and of the weathering of rocks and the corruption of vegetable and animal life.

This common experience is corroborated by the natural sciences, which have taught people to understand these and other similar changes as processes of destruction and construction of corporeal substances in their chemical elements, that is to say, in their tiniest parts, the chemical atoms. Going still farther, natural science made known that this chemico-physical mutability is not, as the ancients thought, restricted to terrestrial bodies, but even extends to all the bodies of our solar system and of the great universe, which the telescope, and still more the spectroscope, have demonstrated to be composed of the same kind of atoms.

b) in the microcosm:

Nevertheless, in the face of the undeniable mutability of even inanimate nature, there still rises the enigma of the unexplored microcosm. It seemed, in fact, that, unlike the organic world, inorganic matter was in a certain sense immutable. Its tiniest parts, the chem-

ical atoms, were indeed capable of combining in most diversified manners, but they appeared to be endowed with a privilege of eternal stability and indestructibility, since they emerged unchanged from every chemical synthesis and analysis. A hundred years ago, the elementary particles were still regarded as simple, indivisible and indestructible.

The same idea prevailed regarding the material energy and forces of the cosmos, especially on the basis of the fundamental laws of the conservation of mass and energy. Some natural scientists went so far as to consider themselves authorized to formulate in the name of their science a fantastic monistic philosophy whose sorry memory is linked up, among others, with the name of Ernst Haeckel. But in the very life-time of the latter, towards the end of the last century, even this over-simplified conception of the chemical atom was shattered by modern science. The growing knowledge of the periodic system of chemical elements, the discovery of the corpuscular radiations of radioactive elements, along with many other similar facts, have demonstrated that the microcosm of the chemical atom, with dimensions as small as ten-millionths of a millimeter, is a theater of continuous mutations, no less than the macrocosm known to all.

It was in the sphere of electronics that the character of mutability was first established. From the electronic structure of the atom there emanate radiations of light and heat, which are absorbed by outside bodies, corresponding to the energy level of the electronic orbits. In the exterior parts of this sphere there take place the ionization of the atom and the transformation of energy in the synthesis and analysis of chemical combinations. At that time, however, it was possible to suppose that these chemico-physical transformations provided one last refuge for stability, since they did not reach the very nucleus of the atom, which is the seat of its mass and of the positive electric charge which determine the place of the chemical atom in the natural system of the elements, and where it seemed science had found, so to speak, an example of an absolutely stable and invariable being.

But already at the dawn of the new century, the observation of radioactive processes, which, in their last analysis, were connected with a spontaneous breaking down of the nucleus, began to exclude any such example. Hence, once science had established the fact of instability reaching down into the deepest depths of known nature, there still remained one further perplexing fact, since the atom was apparently unattackable, at least by human forces, because in the beginning all efforts to hasten or to retard its natural radioactive disintegration, or even to break down inactive nuclei, had failed. The first very modest attempt to break down the nucleus (of nitrogen) goes back to hardly more than three decades ago, and it is only in recent years that it has been possible, by bringing into play tremendous forces, to produce very numerous processes involving the formation and the breaking down of nuclei.

Although this result—which, insofar as it contributes to the cause of peace, is certainly to be inscribed among the glories of our century—represents in the field of practical nuclear physics no more than a preliminary step, nevertheless, it provides for our consideration an important conclusion, namely, that atomic nuclei are indeed, by many orders of magnitude, more firm and stable than ordinary chemical compositions, but this notwithstanding, they are also, in principle, subject to similar laws of transformation, and hence are mutable.

At the same time it was possible to establish that such processes have the greatest importance in the economy of energy of the fixed stars. In the center of our sun, for example, according to Bothe, and in the midst of a temperature which goes as high as some twenty million degrees, there takes place a chain-reaction returning upon itself, in which four hydrogen nuclei combine with one nucleus of helium. The energy thus liberated comes to compensate the loss involved in the radiation of the sun itself. Also in modern physical laboratories, through bombardment with particles endowed with tremendous energy or with neutrons, successful efforts are being made to effect transformations of nuclei, as can be seen in

the example of the atom of uranium. In this connection mention must also be made of the effects of cosmic radiation, which can break down even the heaviest atoms, thus not infrequently liberating entire swarms of sub-atomic particles.

We have desired to cite only some few examples, but such as could establish beyond all possible doubt the explicit mutability of the inorganic world, large and small: the countless transformations of the forms of energy, especially in the chemical decompositions and combinations taking place in the macrocosm and, in no smaller degree, the mutability of chemical atoms, even down to the sub-atomic particles of their nuclei.

Therefore, the scientist of today, directing his gaze more deeply into the heart of nature than his predecessor of a hundred years ago, knows well that inorganic matter is, so to speak, in its innermost being, countersigned with the stamp of mutability, and that, consequently, its existence and its subsistence demand a reality entirely different and one which is by its very nature invariable.

Just as in a picture done in chiaroscuro, the figures stand out on a background of darkness, and only in this way achieve the full effect of form and life, so also the image of the eternally immutable Being emerges clear and resplendent from the torrent which snatches up and carries off with itself all the material things of the macrocosm and the microcosm in an intrinsic mutability which knows no pause. The scientist who stops on the bank of this immense torrent finds rest in that cry of truth with which God defined Himself: "I am who am" (Exod., 3, 14), the God to whom the Apostle gives praise as to "the Father of lights, with whom there is no change or shadow of alteration" (James, 1, 17).

B. The Direction of Transformations

a) in the macrocosm: the law of entropy

Modern science has not only widened and deepened our knowledge of reality

and the vastness of the mutability of the cosmos; it likewise provides us with valuable indications on the direction taken by the processes of nature. As late as a hundred years ago, especially after the discovery of the law of the conservation of energy, it was thought that natural processes were reversible. Consequently, in conformity with the principles of the strict causality, or rather the determination, of nature, an ever-recurring renovation and rejuvenation of the cosmos was regarded as possible. Through the law of entropy, however, discovered by Rudolph Clausius, it was recognized that the spontaneous processes of nature are always accompanied by a diminution of free and utilizable energy. In a closed material system, this conclusion must lead eventually to the cessation of processes on a macroscopic scale. This unavoidable fate, from which only hypotheses—sometimes unduly gratuitous, such as that of continued supplementary creation—have endeavored to save the universe, but which instead stands out clearly from positive scientific experience, postulates eloquently the existence of a Necessary Being.

b) in the microcosm:

In the microcosm, this law, which is basically statistical, is not applicable. Besides, at the time it was formulated, practically nothing was known regarding the structure and the behavior of the atom. However, recent atomic research, as well as the unexpected progress of astrophysics, have made it possible to achieve surprising discoveries in this field. Here we can only allude briefly to the results of these discoveries, but they can be summed up by saying that both atomic and intro-atomic development are clearly marked with a sense of direction.

To illustrate this fact, it will be sufficient to cite the example, already mentioned of the behavior of solar energy. The electronic structure of the chemical atoms in the sun's photosphere releases at every moment into the surrounding space a gigantic quantity of radiant energy which does not return. This loss is compensated from within the sun through the formation of helium from hydrogen. The energy thus released comes from the mass of the

hydrogen nuclei which, in the course of this process and in a small degree (7 per cent), is converted into equivalent energy. Therefore, the process of compensation takes place at the expense of the energy which, originally, in the hydrogen nuclei, exists as a mass. Thus, in the course of billions of years, through a progress which is slow yet irreversible, this energy is transformed into radiations. A similar process is found in all radioactive processes, whether they be natural or artificial.

Thus here also, in the microcosm strictly and properly so-called, we find a law indicating the direction of evolution, a law which is analogous to the law of entropy for the macrocosm. The direction of spontaneous evolution is determined through the diminution of utilizable energy in the structure and the nucleus of the atom and, up to the present time, science knows of no processes capable of compensating or annulling this exploitation through the spontaneous formation of nuclei having high energy value.

C. The Universe and Its Developments

If the scientist turns his attention from the present state of the universe to the future, even the very remote future, he finds himself constrained to recognize, both in the macrocosm and in the microcosm, that the world is growing old. In the course of billions of years, even the apparently inexhaustible quantities of atomic nuclei lost utilizable energy and, so to speak, matter becomes like an extinct and scoriform volcano. And the thought comes spontaneously that if this present cosmos, today so pulsating with rhythm and life, is, as we have seen, insufficient to explain itself, with still less reason will any such explanation be forthcoming from the cosmos over which, in its own way, the shadow of death will have passed.

Let us now turn our attention to the past. The farther back we go, the more matter presents itself as always more enriched with free energy, and as a theater of vast cosmic disturbances.

Thus everything seems to indicate that the material universe had in finite times a mighty beginning, provided as it was with an indescribably vast abundance of energy reserves, in virtue of which, at first rapidly and then with increasing slowness, it evolved into its present state.

This naturally brings to mind two questions:

Is science in a position to state when this mighty beginning of the cosmos took place? And, secondly, what was the initial or primitive state of the universe?

The most competent experts in atomic physics, in collaboration with astronomers and astrophysicists, have attempted to shed light on these two difficult but extremely interesting problems.

D. The Beginning in Time

First of all, to quote some figures—which aim at nothing else than to give an order of magnitude fixing the dawn of our universe, that is to say, to its beginning in time—science has at its disposal various means, each of which is more or less independent from the other, although all converge. We point them out briefly:

1. *Recession of the spiral nebulae or galaxies*

The examination of various spiral nebulae, especially as carried out by Edwin W. Hubble at the Mount Wilson Observatory, has led to the significant conclusion, presented with all due reservations, that these distant systems of galaxies tend to move away from one another with such velocity that, in the space of 1,300 million years, the distance between such spiral nebulae is doubled. If we look back into the past at the time required for this process of the "Expanding Universe," it follows that, from one to ten billion years ago, the matter of the spiral nebulae was compressed into a relatively restricted space, at the time the cosmic processes had their beginning.

2. *The age of the solid crust of the earth*

To calculate the age of original radioactive substances, very approximate data are taken from the transformation of the isotope of uranium 238 into an isotope of lead (RaG), or of an isotope of uranium 235 into actinium D (AcD), and of the isotope of thorium 232 into thorium D (ThD). The mass of helium thereby formed can serve as a means of control. This leads to the conclusion that the average age of the oldest minerals is at the most 5 billion years.

3. *The age of meteorites*

The preceding method adopted to determine the age of meteorites has led to practically the same figure of 5 billion years. This conclusion assumes special importance from the fact that today the inter-stellar origin of meteorites is generally admitted by all.

4. *The stability of the systems of double stars and starry masses*

The oscillations of gravitation between these systems, as also the attrition resulting from tides, again limit their stability within a period of from 5 to 10 billion years.

Although these figures may seem astounding, nevertheless, even to the simplest of the faithful, they bring no new or different concept from the one they learned in the opening words of Genesis: "In the beginning. . .," that is to say, at the beginning of things in time. The figures we have quoted clothe these words in a concrete and almost mathematical expression, while from them there springs forth a new source of consolation for those who share the esteem of the Apostle for that divinely inspired Scripture, which is always useful "for teaching, for reproving, for correcting, for instructing" (2 Tim., 3, 16).

E. The State and Quality of Original Matter

In addition to the question of the age of the cosmos, scholars have, with similar earnestness and liberty of research and verification, turned their daring genius to the other problem which has already been mentioned and which is certainly more difficult, concerning the state and quality of primitive matter.

According to the theories serving as their basis, the relative calculations differ in no small degree from one another. Nevertheless, scientists agree in holding that not only the mass but also the density, pressure and temperature of matter must have reached absolutely enormous proportions, as can be seen from the recent work of A. Unsold, director of the Observatory of Kiel (*Kernphysik und Kosmologie*, in the *Zeitschrift für Astrophysik*, 24, B, 1948, pag. 278-305). Only under such conditions can we explain the formation of heavy nuclei and their relative frequency in the periodic system of the elements.

Rightly on the other hand, does the mind in its eagerness for truth insist on asking how matter reached this state, which is so unlike anything found in our own everyday experience, and it also wants to know what went before it. In vain would he seek an answer in natural science, which declares honestly that it finds itself face to face with an insoluble enigma. It is true that such a question would demand too much of natural science as such. But it is also certain that the human mind trained in philosophical meditation penetrates more deeply into this problem.

It is undeniable that when a mind enlightened and enriched with modern scientific knowledge weighs this problem calmly, it feels drawn to break through the circle of completely independent or autochthonous matter, whether uncreated or self-created, and to ascend to a creating Spirit. With the same clear and critical look with which it examines and passes judgment on facts, it perceives and recognizes the work of creative omnipotence, whose power, set in motion by the mighty "Fiat" pronounced billions of years ago by the Creating Spirit, spread out over the universe, calling into existence with a gesture of generous love matter bursting with energy. In fact, it would seem that present-day science, with one sweeping step back across millions of centuries, has succeeded in bearing witness to that primordial "Fiat lux" uttered at the moment when, along with matter, there burst forth from nothing a sea of light and radiation, while the

particles of chemical elements split and formed into millions of galaxies.

It is quite true that the facts established up to the present time are not an absolute proof of creation in time, as are the proofs drawn from metaphysics and Revelation in what concerns simple creation, or those found on Revelation if there be question of creation in time. The pertinent facts of the natural sciences, to which We have referred, are awaiting still further research and confirmation, and the theories founded on them are in need of further development and proof, before they can provide a sure foundation for arguments which, of themselves, are outside the proper sphere of the natural sciences.

This notwithstanding, it is worthy of note that modern scholars in these fields regard the idea of the creation of the universe as entirely compatible with their scientific conceptions and that they are even led spontaneously to this conclusion by their scientific research. Just a few decades ago, any such "hypothesis" was rejected as entirely irreconcilable with the present state of science. As late as 1911, the celebrated physicist Svante Arrhenius declared that "the opinion that something can come from nothing is at variance with the present-day state of science, according to which matter is immutable." (*Die Vorstellung vom Weltgebäude in Wandel der Zeiten*, 1911 p. 362). In this same vein we find the statement of Plate: "Matter exists. Nothing can come from nothing, hence matter is eternal. We cannot admit the creation of matter." (*Ultramontane Weltanschauung und Moderne Lebenskunde*, 1907, p. 55).

On the other hand, how different and much more faithful a reflection of limitless visions is the language of an outstanding modern scientist, member of the Pontifical Academy of Science, when he speaks of the above-mentioned inquiries into the age of the world:

These different calculations point to the conclusion that there was a time, some nine or ten billion years ago, prior to which the cosmos, if it existed, existed in a form totally different from anything we know, and this form constitutes the very last

limit of science. We refer to it perhaps not improperly as creation. It provides a unifying background, suggested by geological evidence, for that explanation of the world according to which every organism existing on the earth has a beginning in time. Were this conclusion to be confirmed by future research, it might well be considered as the most outstanding discovery of our times, since it represents a fundamental change in the scientific conception of the universe, similar to the one brought about four centuries ago by Copernicus. (*Space and Spirit*, by Sir Edmund Whittaker, 1946, pp. 118-119).

What then is the importance of modern science for the argument for the existence of God based on the mutability of the cosmos? By means of exact and detailed research into the macrocosm and the microcosm, it has considerably broadened and deepened the empirical foundation on which this argument rests, and from which it concludes to the existence of an *Ens a se*, immutable by His very nature. It has, besides, followed the course and the direction of cosmic developments, and, just as it was able to get a glimpse of the term towards which these developments were inexorably leading, so also has it pointed to their beginning in time some five billion years ago. Thus, with that concreteness which is characteristic of physical proofs, it has confirmed the contingency of the universe and also the well-founded deduction as to the epoch when the cosmos came forth from the hands of the Creator.

Hence, creation took place in time. Therefore, there is a Creator. Therefore, God exists! Although it is neither explicit nor complete, this is the reply we were awaiting from science, and which the present human generation is awaiting from it. It is a reply which bursts forth from mature and calm consideration of only one aspect of the universe, namely, its mutability. But this is already enough to make the entire human race, which is the peak and the rational expression of both the macrocosm and the microcosm, become conscious of its exalted Maker, realize that it belongs to Him in space and in time and then, falling on its knees

before His sovereign majesty, begin to invoke His name: "*Rerum, Deus, tenax vigor, Immotus in te permanens, Lucis diurnae tempora, Successibus determinans.*"—"O God, creation's secret force, Thyself unmoved, yet motion's source, Who from the morn till evening's ray, through every change dost guide the day." (Hymn for None).

The knowledge of God as sole Creator, now shared by many modern scientists, is indeed the extreme limit to which human reason can attain. Nevertheless, as you are well aware, it does not constitute the last frontier of truth. In harmonious cooperation, because all three are instruments of Truth, like rays of the same sun, science, philosophy and, with still greater reason, Revelation, contemplate the substance of this Creator whom science has met along its path, unveil His outlines and point out His features. Revelation, above all, makes His presence, so to speak, immediate, vitalizing and loving, like that presence of which either the simple faithful or the scientist is aware in his inner soul when he recites unhesitatingly the concise terms of the ancient Apostles' Creed: "I believe in God, the Father Almighty, Creator of heaven and earth."

Today, after so many centuries,

which were centuries of civilization because they were centuries of religion, the need is not so much to reveal God for the first time, as it is rather to recognize Him as a Father, reverence Him as a Lawgiver, and fear Him as a Judge. If they would be saved, the nations must adore the Son, the loving Redeemer of mankind, and bow to the loving inspirations of the Spirit, the fruitful Sanctifier of souls.

This persuasion, taking its remote inspiration from science, is crowned by Faith which, being ever more deeply rooted in the consciousness of the people, will truly be able to assure basic progress for the march of civilization.

This is a vision of the whole, of the present as of the future, of matter as of the spirit, of time as of eternity, which, as it illuminates the mind, will spare to the men of today a long tempestuous night.

It is that Faith which at this moment inspires Us to raise towards Him whom we have just invoked as *Vigor, Immutus* and *Pater*, a fervent prayer for all His children entrusted to our care: "*Largire lumen vespere, Quo vita nusquam decidat,*"—"Grant us light in the evening so that life may never fail"—"light for the life of time, light for the life of eternity." (Hymn for None).



Spiritual Welfare

We are fully cognizant of the fact that we are living in restless and exciting times, breeding a sense of insecurity and making demands upon all of a person's resources. Therefore, while we diagnose and prescribe for physical ills, we should do something to produce stable emotions and to strengthen moral and spiritual convictions. Only in this way shall we be able to develop in the life of the individual those inner resources which will constitute her defense against distracting environmental influences.

While this is a task which challenges all educators, it is inherent in the

Christian philosophy of education. For to teach the fact of one's dependence on God, is not only good religion but good health education. That is definitely a part of our program at Cedar Crest. We are as much concerned with the moral and spiritual welfare of our students as with their physical education and mental development. We are not only morally convinced of the rightness of this philosophy of education, but we are practically persuaded by the results of it in the lives of our students and of our graduates.—President Dale H. Moore, Cedar Crest College, *Cedar Crest College Bulletin*.

NEW BOOKS

This section offers brief, mostly uncritical reports on the general content of recent publications in biological and related fields. Only the longer critical reviews will be signed. For quick location on library shelves, each notice will be preceded, wherever possible, by three groups of numbers, the first two of which will be the Dewey and the Library of Congress classified numbers respectively. The third group is the L.C. card number, for the convenience of Librarians.

AGRICULTURE AND FARM LIFE, by H. A. PHILLIPS, E. A. COCKEFAIR & J. W. GRAHAM; The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.; 1952, 516 pp., illus.

630 S495.P47 Agr 52-34

Three members of the Warrensburg Missouri State Teachers College present the second revised edition of their original 1939 text. It is well illustrated and annotated, with special appeal to students at the senior high school or junior college levels.

APHID GENUS PERIPHYLLUS, by E. O. ESSIG & F. ABERNATHY; University of California Press, Berkeley 4, California; 1952, 166 pp., 43 fig.

595.7525 QL523.A6E66 52-9559

This is a systematic, biological and ecological study of the aphids which infest the various American and Japanese maples and the box-elders. There is a fifteen-page bibliography.

BASIC BIOLOGY OF MAN, by G. KASTEN TALLMADGE; Random House, 457 Madison Ave., New York 22, N. Y.; 1952, 244 pp., 16 illus., \$3.00.

612 QP514.T3 52-5552 rev.

The Professor of Medical History at Marquette University who is also a Ph.D. from the University of Wisconsin, here presents an authoritative guide to the structure and functions of the human body. Dr. Tallmadge has given the layman a manual which should go far to stop the quackery of nostrum-peddlers.

BETTER FLOWERS FOR YOUR HOME GARDEN, by JOHN HAYES MELODY; Grosset and Dunlap, 1107 Broadway, New York 10, N. Y.; 1952, 162 pp., 161 illus., \$1.50.

635.9 SB405.M42 Agr 52-435

This is one of the latest in the Melody Garden Books Series. The others deal respectively with fruits, lawns and with vegetables and can be purchased in sets of four. This work covers season flowers, hardy perennials, hedges and ground covers. Special gardens such as borders, rackeries, herb gardens are all given extended treatment. Those who seek to acquire the "green thumb" will find it most practical and interesting.

BIOCHEMICAL STUDIES OF BACTERIAL VIRUSES, by E. A. EVANS, JR.; The University of Chicago Press, 5750 Ellis Ave., Chicago 37, Ill.; 1952, 68 pp., 24 tables, 6 fig., \$2.75.

576.6 (589.95) QR511.K8 52-11058

This is a slender little book directed to those professionally interested in other fields whose work calls for authoritative information on bacteriological viruses. Dr. Evans, Chairman of the University of Chicago Biochemical Department here consolidates matter presented in a series of lectures at Iowa State College under the auspices of the Institute of Atomic Research.

BIOLOGY AND LANGUAGES, by J. H. WOODGER; Cambridge University Press, 32 East 57th St., New York 22, N. Y.; 1952, 364 pp., \$8.00.

This is an introduction to the methodology of the Biological Sciences including medicine by the Professor of Biology at the University of London. Part I explains structure and relations of biological statements; Part II applies these results to methodological problems of genetics; Part III follows the same procedure in connection with neurology and kindred subjects.

BIOTIC WORLD AND MAN, by LOUIS J. & MARGERY J. MILNE; Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y.; 1952, 588 pp., illus., \$9.00.
574 QH308.M53 52-8609

These authors who hail from the University of New Hampshire have a distinct achievement in biological textbook writing to their credit. A few sentences from the foreword summarize their aims.

"In this new book on living things, the authors are expressing their own enthusiasm for the broad and integrated approach . . ." "The field of biology is so vast, and annual additions to it so impressive, that elimination of nonessential information seems of paramount importance . . ." "To save space for emphasis on biological principles and the values of biological study to mankind, we have dispensed with much cherished terminology and detail . . ." "We have tried to avoid terms for the sake of such, but rather to introduce only those that would be needed and met again."

The book must be seen to be appreciated.

DYNAMIC ASPECTS OF BIOCHEMISTRY, by E. BALDWIN; Cambridge University Press, 32 East 57th St., New York 22, N. Y.; 1952, 544 pp., 38 fig., 37 tables, \$5.00.
574.19 QH345.B33 52-10733

This is the revised textbook used at Cambridge for the teaching of biochemistry as an independent scientific discipline instead of an adjunct to clinical problems. Changes from the edition of 1947 include a new chapter on biological energetics revised material on enzymes, chapters on metabolism brought up to date with latest discoveries, and a much enlarged bibliography. The book should be a valuable reference for all engaged in the physiological aspects of biology.

THE EPIGENETICS OF BIRDS, by C. H. WADDINGTON; Cambridge University Press, 32 East 57th St., New York 22, N. Y.; 1952, 272 pp., 70 fig., \$7.00.

The central purpose of this book is to review the literature since 1930 dealing with the primary stages of morpho-

genesis. Technical methods of *in vitro* cultivation, the early development of the endoderm, its epigenetic processes, the organization center at the primitive-streak stage, together with a quick survey of other organ systems in later stages make up most of the book.

FIELD CROP INSECTS, by F. A. FENTON; The Macmillan Company, 602 Fifth Ave., New York 11, N. Y.; 1952, 405 pp., 224 fig., \$5.75.
632 SB933.F34 Agr 52-420

Here is a new work on agricultural insects based on the course offered by the Professor of Entomology at Oklahoma A. and M. College. The book is no taxonomic study. It tackles the problem from the control angle. As such it should be regarded not only as a very usable text book but also as a farmer's guide.

FIELD GUIDE TO THE MAMMALS, by W. H. BURT & R. P. GROSSENHEIDER; Houghton Mifflin Co., 2 Park St., Boston, Mass.; 1952, 200 pp., illus. and maps, \$3.75.
599 QL715.B8 52-8269

This latest addition to the Peterson series of field guides contains some of the most attractive color illustration work to be seen in modern biology, coming as it does from the brush of Richard Grossenheider. Text and maps are by William Burt. Taken together, they result in one of the finest new field manuals available. The National Wildlife Federation and the National Audubon Society sponsor its production.

FLORA OF THE BRITISH ISLES, by A. R. CLAPHAM, T. G. TUTIN & E. F. WARBURG; Cambridge University Press, 32 East 47th St., New York 22, N. Y.; 1952, 1591 pp., 79 fig., \$9.50.
581.942 QK306.C57 52-8880

This is to British flora what Fernald's edition of Asa Gray or what, Britten and Brown are to American flora and taxonomic work. Sir Arthur Tansley, the ecologist, suggested the need of this work,—hence this volume.

THE FLOWER GARDEN, by E. R. JONES; Penguin Books, Inc., 3300 Clipper Mill Rd., Baltimore 11, Md.; 1952, 420 pp., 78 illus., 85 cents.

Another in the ever-increasing list of good Penguin books devoted to common-sense instructions for those who want to embark or continue on their practical application of botanical principles.

GARDENS OF THE ANTILLES, by JOHN V. WATKINS; University of Florida Press, Gainesville, Fla.; 1952, 244 pp., illus., \$3.75.
635.909729 SB39.W3 52-2025

This study of nursery practices and plant propagation techniques in botanical gardens, state forests and plantations, is the result of two summers' work in the Caribbean Sea. Islands visited and studied include Cuba, Jamaica, Haiti, the Dominican Republic, Puerto Rico, St. Thomas, the Leeward and the Windward Isles. There is a check list of ornamental plants, and a bibliography.

GARDENER'S COOKBOOK, by JEAN KROFSKY; Thomas Y. Crowell Co., 432 Fourth Ave., New York 16, N. Y.; 1952, 152 pp., \$2.50.
641.65 TX801.K7 52-7037

Perhaps no phase of American cookery is so colorless as the preparation of garden vegetables. Perhaps no other reason explains so well why there is so much wastage when seasonal crops become too plentiful in the home garden and people get "sick and tired" of too much of the same items on the family menu. Here we have the solution of this problem. There are, for example, eight ways to serve green beans, ten for beets, seven for brussels sprouts, eighteen for cabbage, twelve for carrots, and eighteen more for potatoes. Tomatoes rate highest with twenty-two recipes.

GARDENER'S TROUBLE SHOOTER, by V. H. RIES; Sheridan House, 257 Fourth Ave., New York 10, N. Y.; 1952, 320 pp., illus., \$3.50.
634 SB605.U5R5 52-8097

The Extension Professor of Floriculture at Ohio State University has recorded here some of the commonest garden problems he encountered while running his columns in "The Flower Grower" and "Country Gentleman" in a very down-to-earth and engaging

fashion. If all scientific books were written half as interestingly as the horticulturists seem to enjoy doing, maybe there would be more intelligent people who would make hobbies of scientific research. The chapter on "Meet the Pests Personally" is excellent and "Plants and Their Problems" is priceless.

HANDBOOK FOR ETIOLOGY, DIAGNOSIS AND CONTROL OF INFECTIOUS BOVINE MASTITIS, by I. A. MERCHANT & R. A. PACKER; Burgess Publishing Co., 426 South 6th St., Minneapolis 15, Minn.; 1952, 85 pp.
636.2089871 SF871.M42 Agr 52-422

This revised edition brings the original 1944 version up to date on the newer knowledge and therapeutic agents important to the control of mastitis.

HANDBOOK ON V. D. by CARROLL T. BOWEN; University of Miami Press, Coral Gables 46, Fla.; 1952, 66 pp., \$1.25.

Dr. Carroll T. Bowen is a Florida Health Officer in Broward and Levy Counties. He hasn't pulled any punches in his treatment of his subject.

A HUNDRED YEARS OF BIOLOGY, by BEN DAWES; The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.; 1952, 429 pp., 24 fig., 11 tables, \$5.00.
574.09 QH305.D3 52-11434

This is the biological volume in the Duckworth "Hundred Years" series. It summarizes research and discovery over the last 100 years under the following headings: protoplasm and cell reproduction, development, growth, heredity, taxonomy, receptors and effectors, nervous coordination, behavior, evolution, marine biology, parasites, antibiotics and agricultural biology.

INSECT RESISTANCE TO CROP PLANTS, by REGINALD H. PAINTER; The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.; 1952, 520 pp., 67 fig., 25 tables, \$7.25.
633 SB608.F33P3 Agr 51-540

Although each of the nine chapters has its own three or four-page bibliography there are *sixty-one* pages of additional titles, listed for reference in

the general bibliography just preceding the rather copious index. The book covers the mechanisms of resistance, factors affecting it, resistance to insects in wheat, corn, cotton, sorghums and potatoes. Methods in breeding for resistance close the book.

INTRODUCTION TO ACAROLGY, by E. W. BAKER & G. W. WHARTON; The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.; 1952, 465 pp., 377 fig., \$10.00.

595.42 QL458.A2B16 52-852

This new work is designed to meet the demands for an elementary and comprehensive work on mites, especially from those interested in entomology, parasitology as well as general zoology. This book begins with technical information on the life histories, structure and habits of these spider-like forms. By far the largest number of pages is devoted to a taxonomic study, with keys for every suborder.

THE LIVING BODY, by C. H. BEST & N. B. TAYLOR, Henry Holy & Co., 383 Madison Ave., New York 17, N. Y.; 1952, 792 pp., 400 illus., \$5.50.

612 QP34.B52 52-7025

This third edition of a popular text on human physiology includes two new chapters on elementary physical and chemical principles as well as the defensive mechanisms of the body against disease and injury. The inclusiveness of the work can be judged from its 41-page index with over 100 references on each page. Drs. Best and Taylor are professors at the University of Toronto. Both hold Canadian as well as British degrees or fellowships.

MICROBIOLOGY OF WATER AND SEWAGE, by P. L. GAINES & T. H. LORD; Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y.; 1952, 430 pp., illus., \$7.85.

628 QR53.634 52-10270

Originally published as parts of "Microbiology of Water and Sewage for Engineering Students", this rewritten work has been designed to serve two purposes: to introduce the student into bacteriology (first six chapters), and then to go on to problems of pure

water supply, pollution, water softening, sewage treatment and disposal.

MORPHOGENESIS, by J. T. BONNER; Princeton University Press, Princeton, N. J.; 1952, 296 pp., 90 fig., \$5.00.
575.6 QH491.B6 52-5847

Subtitled "An Essay on Development," this work is derived from a course on "Growth and Form" given at Princeton University. It covers size and pattern, physics and chemistry in development, patterns in growth, patterns in morphogenetic movements, polarity and symmetry, patterns of differentiation, and an analysis of development.

MUSCULOSKELETAL SYSTEM, edited by MAHLON ASHFORD; The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.; 1952, 368 pp., 103 fig., \$6.50.
616.7 RC925.N46 52-8700

This is a report of the twenty-third graduate fortnight of the New York Academy of Medicine in October 1950 in which there were sixteen papers presented. They form a connected series ranging from the structure and reactivity of connective tissue through the various phases of muscular bone and joint afflictions. Medical men, particularly osteologists and osteopaths, will naturally find this most interesting. **NEW BIOLOGY**, NO. 12, edited by M.

L. JOHNSON & M. ABERCROMBIE; Penguin Books, Inc., 3300 Clipper Mill Road, Baltimore 11, Md.; 1952, 126 pp., 50 cents.

Eight articles by J. B. S. Haldane, R. E. Bellingham, R. L. Wain, W. J. Rees, J. Penet, and G. E. H. Foxon. There are also two N. W. Pirie reviews of books by V. M. Goldschmidt and J. D. Bernal. The subjects treated range from skin grafting in cattle twins through copper fungicides, octopi in the English Channel, biochemistry and bacteria, to the action of frog hearts.

OUR GARDEN SOILS, by CHARLES E. KELLOGG; The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.; 1952, 232 pp., 9 tables, 5 fig., \$4.00.
631.4 S597.K4 52-1530

Green thumb or not, anyone interested in growing things might easily

be captured in this book. There are ten chapters dealing with soil origins, organic matter, soil relations, pH, nutrients, lawns, transplanting, and garden planning. The latter fifth of the book is given over to lists of plants by groups and their soil preferences. There is also a bibliography and list of agricultural experiment stations.

PLANTS FOR MAN, by ROBERT W. SCHERY; Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y.; 1952, 564 pp., illus., \$10.00.
581.61 SB107.S3 52-7748

Copiously illustrated, thoroughly bibliographed, plentifully mapped, this book would make a helpful nucleus around which to build a course in economic botany. Its 24 chapters are grouped under four headings. The first of these discusses man's dependence on and economic interests in plants. The second section covers products derived from plant cell walls. The third discusses cell exudates and extractions. Final chapters treat of plants and their parts used for foods or beverages. Men who have served in the Armed Forces overseas will meet many once familiar fruits and vegetables again in these pages.

PROBLEMS OF LIFE, by LUDWIG VON BERTALANFFY; John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.; 1952, 216 pp., \$4.00.
574 QH307.B38 52-32827

This is the official translation of the German original published as "Das Biologische Weltbild" in 1949. Like many other German philosophic works of its kind, it is not particularly easy reading. There are six chapters entitled respectively: Basic Conceptions of the Problem of Life, Levels of Organization, Unitary Conception of the Process of Life, Laws of Life, Life and Knowledge, and The Unity of Science. The book is based on the author's own theoretical and practical work in justification of his theory of *organismic conception*.

THE SCIENCE OF BIOLOGY, by W. C. BEAVER; C. V. Mosby Co., 3207 Wash-

ington Ave., St. Louis 3, Mo.; 1952, 895 pp., 375 fig., \$5.85.

This is the fourth edition of a work previously reviewed in these pages. It has been considerably reorganized, always with an eye to better techniques and classroom practice.

SOMEWHERE IN NEW GUINEA, by FRANK CLUNE; Philosophical Library, 16 East 40th St., New York 16, N. Y.; 1952, 356 pp., illus., \$4.50.
919.5 DU740.C59 52-2588

Here is a refreshingly "different" type of travel book which will interest everyone who ever touched the shores of any part of New Guinea. Each chapter has a black-and-white head-piece or a map to start off with. There is a full bibliography, but no index. This is inconvenient for some of us who want to see what the author had to say about places where we were or went from 1941 to 1945.

WHAT'S INSIDE OF ME?, by HERBERT S. ZIM; William Morrow & Co., 425 Fourth Ave., New York 16, N. Y.; 1952, 32 pp., \$1.75.
612 QP37.Z5 52-5942

Parents who are plagued by the questions of inquisitive children will want to give this book to their curious offspring for Christmas, now, or at any time, depending on the degree of childish curiosity. The book is well illustrated; every other page has some enviably well-drawn illustrations in two colors.

WHAT'S INSIDE OF PLANTS?, by HERBERT S. ZIM; William Morrow & Co., 425 Fourth Ave., New York 16, N. Y.; 1952, 32 pp., illus. in color, \$1.75.
581.1 QK49.Z5 52-5943

This slim book is about as concentrated as anyone could possibly wish, and still remain clear enough for the seven or eight year old youngsters for whom it is intended. The illustrations are sharp and all, except the end papers, in color.

LETTER TO THE CHAPTER OFFICERS

ALL CHAPTER MEMBERS SHOULD READ THIS CAREFULLY: It will answer most of the questions which usually arise during the year.

The first item that should come to the attention of chapter officers is that they are losing the highly valued and efficient service of the Executive Secretary, Dr. Henry van der Schalie. Dr. van der Schalie has served Phi Sigma in this capacity for several years and has given generously of his time and energy to promote the good interests of the Society. His resignation was tendered the Council at its meeting the early part of September 1952, and was occasioned by his appointment to a position in Egypt with the World Health Organization. He will probably return after a year abroad with his family and we hope to welcome him back into the "fold" on his return—his advice and good counsel will always be welcome.

Please note that official communications from chapters to the Council should now be addressed to the new Executive Secretary appointed to serve out the remaining one year of Dr. van der Schalie's term:

Dr. Fred S. Orcutt
P. O. Box 454
Blacksburg, Virginia

The records and materials of the office of Executive Secretary are now at the above address. Your new officer will endeavor to give you the same efficient and understanding service you have received from previous holders of this office.

Phi Sigma Society is now beginning its thirty-eighth year of activity. Our membership is over 17,000 with 34 active chapters located throughout the country, as well as Mexico and the Philippines.

Each year the important office of chapter secretary is likely to change. That officer usually has more to do than the other officers and it is through that individual that the Council maintains its contact with each chapter. Consequently, you are urged to READ

THE FOLLOWING SUGGESTIONS and to make a serious effort to fulfill properly the duties of your office. It will help if you keep these sheets in a convenient place throughout the year for reference.

1. **CHAPTER FILE:** The last serial number in our files for your chapter, _____, is _____. Please check your chapter record files to see if this number agrees with yours. If not, advise the Executive Secretary promptly.

2. **CONSTITUTIONS:** Only the 14th edition with the amendments stapled in the back is official. A copy of the constitution will be given to each initiate without charge to the chapter. Please order the number needed in advance of initiation.

3. **CHAPTER OFFICERS — NAMES AND ADDRESSES:** If you have not already done so, please send a list of the names and addresses of your officers for this school year *immediately*. Send this list even though it may have been sent at the close of school last year. In this way records may be carefully checked and brought up to date. Names of Chapter officers appear in the first issue of THE BIOLOGIST. Please notify this office in case of change of officer or address during the school year. The officers must be those specified in Art. V, Section 1, of the Constitution.

4. **FACULTY REPRESENTATIVE:** Each chapter should arrange to have a permanent faculty member act in the capacity of faculty representative, a person to whom the Council merely may refer Phi Sigma matters when there are no chapter officer lists available or when such officers can not be reached. In order to be sure that we have the name of your faculty representative, please include it in your list of chapter officers being sent to this office.

5. **HOW TO ORDER COPIES OF "THE BIOLOGIST":** Please inform the Treasurer, Mrs. Tema S. Clare, before October 30th if possible, how many copies of THE BIOLOGIST your chap-

ter will need this fall to supply your *active, faculty and honorary* members. A post card addressed to Mrs. Clare is enclosed for this purpose. Be sure to include the name and address of the member to whom the package of BIOLOGISTS is to be sent. Ordinarily, this is the chapter secretary. *It is the duty of the chapter secretary to see that each faculty member and honorary member of his chapter receives a copy.*

6. MEMBERSHIP ELIGIBILITY: Your attention is called to Art. IV, Sec. 2, and the amendment to Sec. 2, of the Constitution, dealing with membership eligibility.

In regard to *honorary members* (see Art. IV, Sec. 5), please note that an honorary member may *not* be elected by a chapter without first receiving the approval of the Council. Do not notify the prospective honorary member before this approval is received from the Council; otherwise an embarrassing situation might arise. *A minimum time of two months for action is required by the Council.* In general, the Council will not approve anyone for honorary membership unless he is starred in *American Men of Science*. Exceptions may be made, of course, but this ruling should be called to the attention of the chapter when names are suggested. The Council has further made the following requirements: "The following information will be required by the Council before it will vote on any proposed honorary member suggested by a chapter:

- (1) A biographical sketch, such as those found in *American Men of Science*,
- (2) A complete list of published papers and books,
- (3) A brief statement telling *why* your chapter feels that the candidate should be chosen for such an honor."

Four copies of this information should be sent to the Executive Secretary's office, with any request for the approval of the election of an honorary member.

7. INITIATION CERTIFICATES: The Council urgently requests that no initiation be held without at least the membership certificate ready to give each initiate *at the time of initiation.*

We feel, also, that an initiation is much less impressive if the Keys are not on hand to be presented to the initiate at the same time. *Please allow a full three weeks after ordering certificates* (see paragraph 8) before you hold an initiation.

8. MEMBERSHIP RECORD BLANKS: Two membership record blanks and two of the 3 x 5 membership file cards (one white and one green) must be filled out by each initiate. The green membership record blank and card are to be kept in your files as permanent records. *The white membership record blank and card must be sent to this office BEFORE the Secretary may order a membership certificate. Please see that these blanks are filled out completely!*

Exceptional care should be given to the *printing of the candidate's name on the first line of the membership blank*, since certificates are ordered lettered as spelled thereon. Check all forms for serial numbers before sending them in. An initiate receives his serial number in alphabetical order (for each group initiated) regardless of the type of membership.

9. KEYS: Order keys directly from our official jeweler (L. G. Balfour, Attleboro, Massachusetts), giving name of person, chapter, and date of initiation for each key ordered. Prompt service may be expected on all orders. Do *not* order through the offices of the Executive Secretary or Treasurer. Sufficient time should be allowed after the election of new members (at least three weeks) so that the key orders and membership certificates will be on hand at the initiation and banquet.

<i>Standard Size</i> (official 10K gold)	
Key, swivel ring top	\$5.50
Key, stationary ring top	5.00
Pin, swivel top	6.75
Pin, stationery top	6.25

<i>Small Size</i> 10K gold	
Key, swivel ring top	\$5.00
Key, stationary ring top	4.50
Pin, stationary top	5.50
Green gold	\$2.00 additional for each key.
White gold	\$5.00 additional for each key.

Federal Tax of 20% should be added to the above prices.

10. **RITUAL:** A copy of the new ritual, the use of which is mandatory, is in the hands of each chapter president; it will be his duty to keep it *personally* and to give it personally to his successor at the proper time. The ritual contains three parts: first, the initiation ceremony proper, second, the ceremony for inauguration of new officers, and third, the ceremony for the installation of a new chapter of Phi Sigma.

11. **CHAPTER SUPPLIES:** Membership record blanks, 3 x 5 cards and constitutions are to be ordered from the office of the Executive Secretary. Membership record blanks are sold at the cost of one cent each; the other items are furnished gratis. On small orders (none less than 24 membership record blanks, please) three-cent stamps may be sent to cover costs. It is suggested that each chapter ordinarily keep on hand a supply of membership record blanks and cards in order that no time be lost after an election. Remember to include your request for constitutions when you send in completed membership blanks.

12. **INITIATION FEES:** Before a certificate may be ordered lettered for a new initiate, the initiation fee (\$7.00), as well as the white membership blank and 3 x 5 card must be received by the Executive Secretary.

Fees are to be sent to:

Fred S. Orcutt, Executive Secretary, Phi Sigma
P. O. Box 454
Blacksburg, Virginia

Make checks or money orders payable to Phi Sigma Society.

Do not send fees to the Treasurer.

If you anticipate any valid reason why the initiation fees cannot accompany the membership blanks sent to the Executive Secretary, you *must* establish a certainty that these funds will follow. This must be done by *previous* correspondence countersigned by your Faculty Representative.

13. **TREASURER:** A report of all initiations is to go to the Treasurer as well as to the Secretary. The following information must be sent to the Treasurer, Mrs. Tema Shults Clare, Dept. of

Botany, University of Southern California, Los Angeles, California, for each initiate: (1) name; (2) serial number; (3) date of initiation of each initiate.

14. **CHAPTER STATIONERY:** Several chapters have written asking where chapter letterheads and envelopes may be obtained. These may be ordered from Mr. E. W. Milligan, c/o Kistler Stationery Company, 1636 Champa Street, Denver, Colorado. This company has the cut for the official coat-of-arms (see first sheet of this letter). Upon request, Kistler's will furnish an assortment of letterhead samples such as are used by several chapters.

15. **COAT-OF-ARMS:** The coat-of-arms and the model key may be ordered from the Executive Secretary's office. Your chapter should have both of these for initiations.

16. **PETITIONS:** Send in votes on petitions for new chapters *promptly*. If no vote is received within six weeks, it will be assumed that your chapter approves the petition.

17. **TRANSFER OF MEMBERSHIP:** Procedure for transferring members to another chapter is given in Art. IV, Sec. 6, of the Constitution. There is no special form required.

18. **CHAPTER EDITOR REPORTS TO "THE BIOLOGIST":** Be sure that your chapter editor provides material regularly for THE BIOLOGIST. These reports or letters should be sent to:

Dr. A. M. Keefe
St. Norbert College
West De Pere, Wisconsin

On behalf of the Council, I wish to extend our best wishes for the coming year. We are always interested in hearing from the individual chapters or members, and glad to assist you in any way possible. The work involved in managing the affairs of the central office in such a large organization as Phi Sigma is considerable; your cooperation in carrying out properly the duties of your offices is indeed appreciated.

Sincerely,
Fred S. Orcutt
Executive Secretary, Phi Sigma

Watch for
YOUR NEXT BIOLOGIST

The Winter Issue will present

"THE ORIGIN AND EVOLUTION OF HOUSEHOLD INSECTS"

By Dr. Melville H. Hatch, University of Washington

"SUGGESTIONS IN RESEARCH METHODOLOGY"

By Dr. Gregorio T. Velasquez, University of the Philippines

"SCIENCE AND PHILOSOPHY"

By Gerard Smith, Marquette University

"PHILIP HENRY GOSSE," Part 2, 'THE GREAT RECONCILER'

By Dr. David Causey, University of Arkansas

PLUS

A Removable full-double-spread Chart:

"CAREERS FOR BIOLOGISTS"

By Dr. Lester P. Coonen, University of Detroit

Also

CHAPTER NEWS, OFFICERS and LETTERS, BOOK NOTES, Etc.

CALL TO CONVENTION

The biennial Convention of Phi Sigma will be held in St. Louis, Missouri, December 28 and 29, 1952, with headquarters at the Statler Hotel. It is at meetings such as this that the operational policies and other business matters are set by the chapters through their delegates. The National Council serves only to carry out constitutional procedures and to afford continuity in organizational matters.

Each chapter is therefore urged to: (1) instruct its delegate in those things which will be called to its attention for action by the National Secretary; (2) bring to the convention any items of new business; (3) study the programs of the concurrent sessions of the American Association for the Advancement of Science and ask delegate to report back on research papers of particular local interest.

Tentatively, the program for the convention is as follows: Deecember 28, morning, registration and certification of delegates; December 28, afternoon, first business session; December 28, Dinner, and Presidential address by Dr. Harley J. Van Cleave; December 28, evening, committee meetings; December 29, morning, free choice of A.A.A.S. sessions; December 29, afternoon, concluding business meeting; December 29, evening, A.A.A.S. exhibit of research in progress, books, instruments, etc.

Travel, and lodging expenses of delegates for December 28 and 29 are paid from the National Treasury. Subsistence is met by the individual or by the local chapter if finances warrant.

KARL F. LAGLER, Chancellor.

Dept. of Fisheries, Univ. of Mich., Ann Arbor, Mich.

CHAPTER OFFICERS

BETA

—University of Michigan

Ann Arbor Michigan

President—P. C. Rajam, Dep't. of Bacteriology, Univ. of Michigan.

Vice-Pres.—Albert Grover, Dep't. of Bacteriology, Univ. of Michigan.

Treasurer—Gerard VanHalsema, Dep't. of Bacteriology, Univ. of Michigan.

Council Rep.—Dr. Karl F. Lagler, Dept. of Nat. Resources, Univ. of Michigan.

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Denver, Colorado

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Vice-Pres.—Steven J. Cieciura, 1260 Pennsylvania, Apt. No. 8, Denver, Colorado.

Corr. Sec., Rec. Sec., & Treasurer—Helen E. Kundert, 2148 South High, Apt. No. 229, Denver 10, Colorado.

Council Rep.—Dr. Frederick Zeiner, 1417 So. Elizabeth, Denver, Colorado.

ZETA

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Madison Wisconsin

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Vice-Pres.—Leslie M. Lueck, Dept. of Pharmacy, Univ. of Wisconsin.

Corr. Sec.—Elizabeth Williams, Dept. of Genetics, Univ. of Wisconsin.

Rec. Sec.—Theodore W. Tibbitts, Dept. of Horticulture, Univ. of Wisconsin.

Treasurer—Robert D. Tinline, Dept. of Plant Pathology, Univ. of Wisconsin.

Editor—Ernest J. Bubieniec, Dept. of Botany, Univ. of Wisconsin.

Council Rep.—O. N. Allen, Agr. Bacteriology, Univ. of Wisconsin.

ETA

—University of Akron

Akron, Ohio

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KAPPA

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Lawrence, Kansas

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Rec. Sec.—Eugene Wittlake, Dept. of Botany, Univ. of Kansas.

Treasurer—Reed Roberts, Dept. of Entomology, Univ. of Kansas.

Editor—Katsuyuki Yokoyama, Dept. of Botany (change to Bernard Greenberg next year)

Council Rep.—Mrs. Ruth K. McNair, Dept. of Biology, Univ. of Kansas.

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Missoula, Montana

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NU

—Washington and Jefferson Col-

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Vice-Pres.—Donald C. Goodman, Dept. of Zoology, 345 Natural History Bldg., Univ. of Ill.

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Editor—Richard G. Van Gelder, Dept. of Zoology, 345 Natural History Bldg., Univ. of Ill.

Council Rep.—Prof. Norman D. Levine, 219 Veterinary Research Center, Univ. of Ill.

SIGMA

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Gainesville, Florida

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Editor—Nicholas Nader, Box 2653 University Station.

Council Rep.—Dr. Pierce Brodkorb, Biology Dept., Univ. of Florida.

PI

—Emory University
Georgia

Dr. W. B. Baker, Dept. Biology, Emory University, Georgia.

UPSILON

—Miami University
Oxford, Ohio

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den Hall, Oxford, Ohio.

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Treasurer—Jo Ann Bowling, 218 North Hall, Oxford, Ohio.

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CHI

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Bozeman, Montana

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Council Rep.—John A. Callenbach, 1414 So. Grand, Bozeman, Montana.

PSI

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Council Rep.—Dr. M. H. Hatch, Dept. Zoology, Univ. of Washington.

OMEGA

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"They Went to College"

That elusive creature, the American college graduate, has long been a figure of myth. In one generation our folklore pictured him as a well-bred snob and her as an intellectual Feminist; after the first World War he used to wear a racoon coat and drive a Stutz Bearcat, and she rolled her stockings and let her overshoes flap; in the thirties he was a wild-eyed radical and she his free-thinking partner; and then the GI Bill brought him back to college wearing his suntans, while she was his hardworking GI bride, mixing domesticity with the Grove of Academe.

But that large and important segment of our population—the six mil-

lion graduates of our 1,300 institutions of higher learning, each one an individual—obviously cannot be typed so easily. The nearest anyone has come to a composite portrait is a survey, recently completed by *Time* Magazine and just published by Harcourt, Brace and Company (*They Went to College* by E. Havemann and P. S. West). This book, by means of 52 illustrated charts and Havemann's very readable prose, dissects and analyzes a considerable sampling of this significant stratum of American society and discusses what it is and how it behaves.—*Harvard Alumni Bulletin*.



DON'T BE CHAIRMAN OF THE BORED!

(1) **Never start a meeting without an agenda**—a list of things to be covered by the meeting. An agenda saves time. An agenda keeps a meeting on the beam.

(2) **State the purpose of the meeting at the beginning and read the agenda aloud.** Odd as it may seem, members of a meeting do not always know why they are there. Informing them of the purpose helps them concentrate on what the meeting is to accomplish. Also, it helps direct their thinking.

(3) **Keep the meeting moving.** Just as a meeting is seldom any better than its chairman, so it is seldom any more productive than the interest of its participating members. Interest flags when action lags. If you are chairman, keep the meeting moving.

(4) **Speak clearly.** If you are the chairman, you are the spearhead of the meeting. You have the agenda. You know what it's all about. If you can't be heard, you can't exercise control.

(5) **Prevent general hubbub.** When everybody talks at once, nobody can be heard. When nobody can be heard, nothing can be accomplished. Insist on order.

(6) **Avoid talking to individuals** without talking to the group. Side conversations between the chairman and individual members disrupt the meeting.

(7) **Keep the speaker talking clearly and audibly.** If a member asks for the floor and is given it, it is up to you to see that he makes proper use of it. Interrupt him if necessary and have him repeat what he has said if you think that not everyone heard him.

(8) **Sum up** what the speaker has said and obtain a decision. Not all members will be good at expressing themselves. It is up to you to determine what they have said and whether or not it has been understood—and to get the decision of all members on the topic.

(9) **Stop aimless discussion** by recommending committee study. Occasionally subjects are discussed on which general agreement at the time cannot be reached. On such occasions, submit the matter to further study by a committee.

(10) **Keep control of the meeting** at all times without stifling free comment. Invite criticism and even disagreement. Also ask for support.

(11) **Don't argue with the speaker.** Ask questions if you disagree. But remember—you, as chairman, are supposed to be neutral. No matter how ardent you feel, let the meeting make the decision. You're conducting a symphony, not playing a solo.

(12) If you have a comment, or feel called upon to take part in partisan discussion, **ask for the floor** as a participant.

(13) **Don't squelch a trouble-maker.** Let the meeting do it—call such trouble-making to the attention of the whole gathering. Again—you must remain impartial. It's the duty of the meeting to pass judgment—not yours. Let the meeting pass judgment not only on the issues but on the conduct of individual members.

(14) **Be aware of the participants' comfort**—temperature-wise, thirst-wise, etc. Members of a meeting are human beings. They are subject to physical laws as well as to your authority.

Developed by Walter Weir for the Michigan Education Journal. Reprinted from the *Mississippi Educational Advance*, April, 1952.

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The Humanistic Outlook

The expansion of classic and humanistic studies in the United States would be warmly welcome in the free countries of Europe, which can all claim a living humanistic tradition. Though many of the effects of such an expansion would not be immediately perceptible, it would no doubt strengthen from the outset the cultural ties and affinities between the United States and its European partners, would deepen their mutual understanding, and would assist them greatly in defending together free culture.

Countries such as Great Britain, France, Italy, Germany, the Netherlands, as well as my own, where classic learning has always been the basic of education, will feel that an America more receptive to the humanistic outlook would broaden the basis of her kingship with Europe by sharing the same cultural treasures and the same scale of spiritual values. However great the moral prestige of America, this would enhance it in the cultural field.

My personal impression is that now would be the time for the Americans who believe in the benefits to be derived from classic and humanistic studies to initiate a drive for their ex-

pansion. Of course, today's trend is towards technical curricula, and some may be inclined to consider classic and humanistic studies as an intellectual luxury, not indispensable to material welfare. But "man shall not live by bread alone." [translated] In the present period of prosperity it should not be difficult, in this country, to give an increased measure of moral and financial support to humanities and liberal arts.

In the history of the Western World, thinkers, political philosophers, or leaders holding the initiative in the field of ideas, were nurtured in the humanistic tradition, which has been the backbone of European education and the source of European renaissances.

The publicity proclaimed aim of American foreign policy is the advancement of peace, freedom, and prosperity in the world. Those fundamental purposes of democracy can be effectively promoted when they are more than political aims and become a way of life. Such a way of life will be fully attained, I believe, only when we can reach a steadier contact with the sources of human learning than we have today. —Ambassador A. G. Politis of Greece, at The University of Pittsburgh.



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- 1915 March 17, Alpha Chapter organized, Ohio State University, Columbus.
- 1916 May, Central Governing Body organized, BIOLOGIST first issued.
- 1917 June, last War-time BIOLOGIST issued.
- 1921 February, BIOLOGIST revived.
- 1924 December, First National Meeting, Constitution revised, Washington, D. C.
- 1925 December, Second National Meeting, First Science Program, Kansas City.
- 1926 December, Third National Meeting, Second Science Program, Philadelphia.
- 1927 December, Third Science Program, Nashville.
- 1928 December, Fourth National Meeting, Coat-of-Arms adopted, Fourth Science Program, New York.
- 1930 January, Council Meeting, Ritual Revised, Norman, Okla.
December, Fifth National Meeting, Fifth Science Program, Cleveland.
- 1931 Phi Sigma Letters Registered, U. S. Patent Office.
- 1932 December, Sixth Science Program, Atlantic City.
- 1933 June, Sixth National Meeting, Seventh Science Program, Chicago.
- 1935 December, Seventh National Meeting, Eighth Science Program, St. Louis.
- 1937 December, Eighth National Meeting, Ninth Science Program, Indianapolis.
- 1939 December, Ninth National Meeting, Tenth Science Program, Silver Anniversary, Ohio State University, Columbus.
- 1941 December, Tenth National Meeting, Dallas, Texas.
- 1946 December, Eleventh National Meeting, Boston, Mass.
- 1948 December, Twelfth Meeting, Eleventh Science Program, Albuquerque, N. Mex.
- 1949 February, Joins the Association of College Honor Societies.
- 1950 December, Thirteenth Meeting, Denver and Boulder, Colorado.